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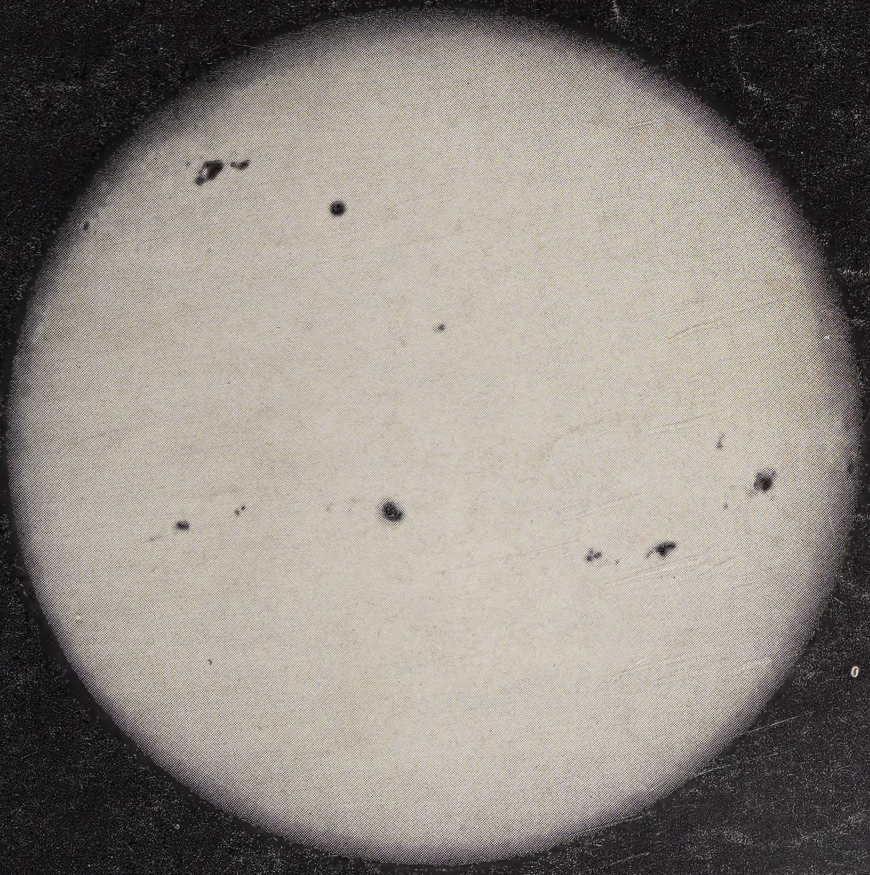

SUNSPOT STORY, CYCLE 19; THE DECLINING YEARS--SEE PAGE 26

The Radio Amateur's Journal

COLLINS

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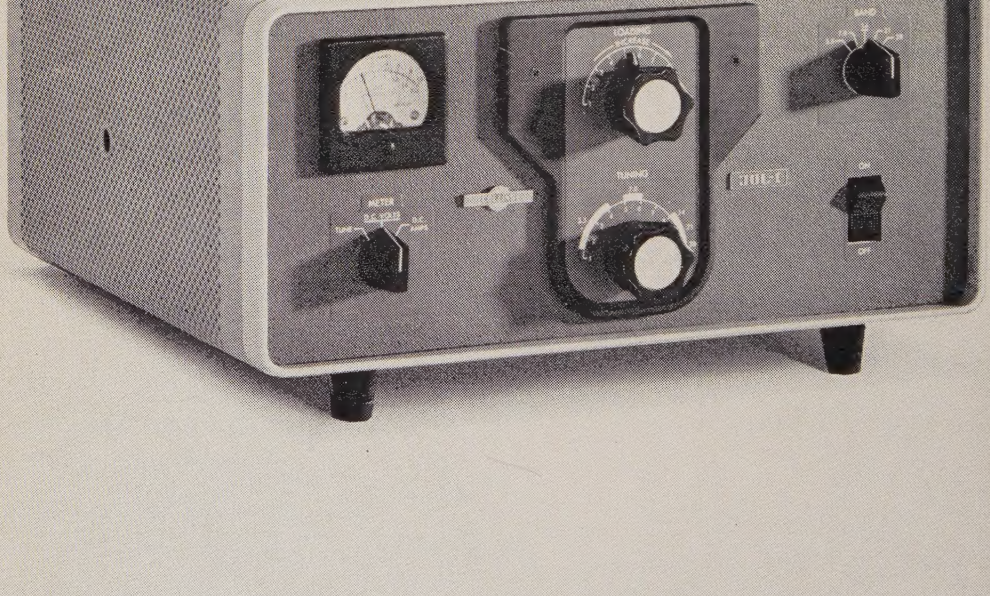
Collins new 30L-1 Linear Amplifier is a compa unit with 500 watt input. Its size is the same Collins famous KWM-2. The 30L-1 is compatib with any 100 watt exciter and has these Collins quality features: RF inver feedback • Automatic Load Control • Self-contained power supply Silicon rectifiers • High/low power switch • Amateur net $520. Ord the 30L-1 now from your authorized Collins Distributor for July deliver



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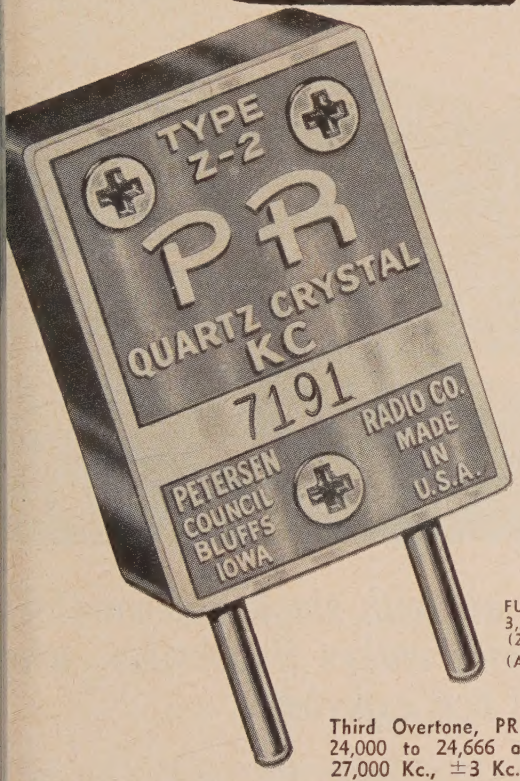

There is a deep, understandable satisfaction in owning something truly fine. It can't be exactly measured in dollars or in words. Maybe it boils down to this: A good thing is worth a hundred times its price; a poor thing isn't worth having around. It's this way with Crystals. When you buy PRs you know you're getting many times your money's worth. You're buying the finest precision frequency control that modern science has made . . . you get (in super-abundance) the things you want most . . . dependability, accuracy, long life, freedom from drift, unfailing activity. Yes—you can be proud to own PRs . . . everybody is!

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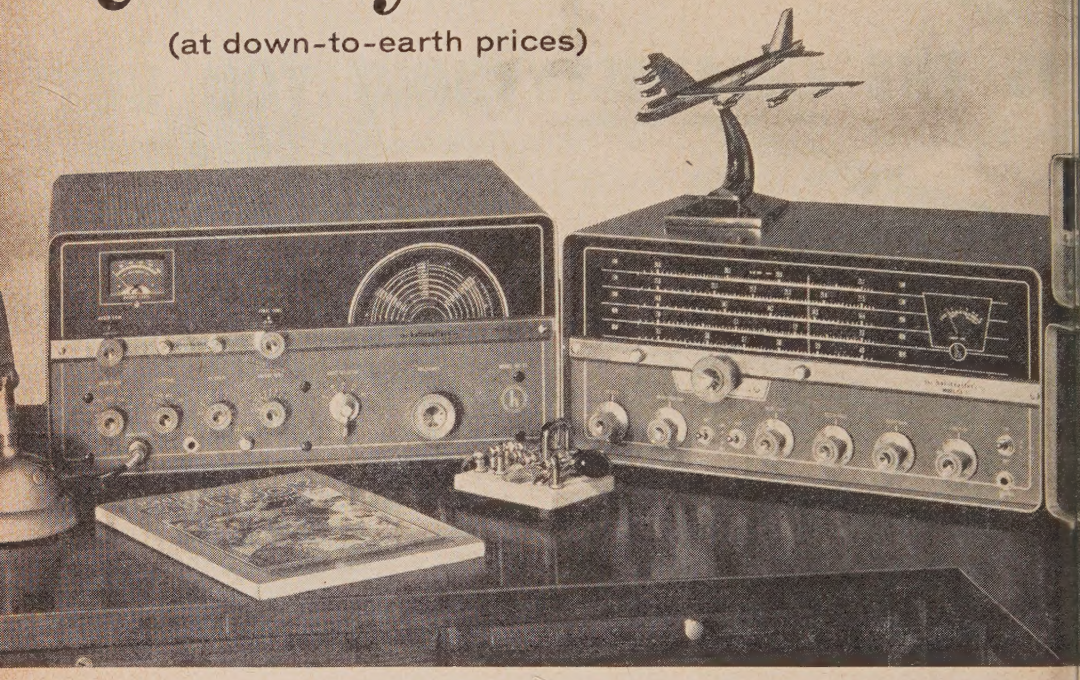

Today . . . you can be on the air with single sideband! Th is the combination whose price makes it possible—who performance makes it a great new experience.

HT-37 Transmitter $450.00 A precision-engineered CW/AM/SSB transmitter with the same power, rugged construction, and long-term frequency and carrier suppression stability as the famous HT-32. Sideband suppression 40 db. at 1000 CPS. Power rating: 70-100 watts P.E.P. output CW or SSB. 17-25 watts carrier on AM phone. 3rd and 5th order distortion products down 30 db. Instant CW CAL signal from any transmission mode. Ideal CW keying; full voice control system. 52-ohm pi network output for harmonic suppression.

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CQ

The Radio Amateur's Journal

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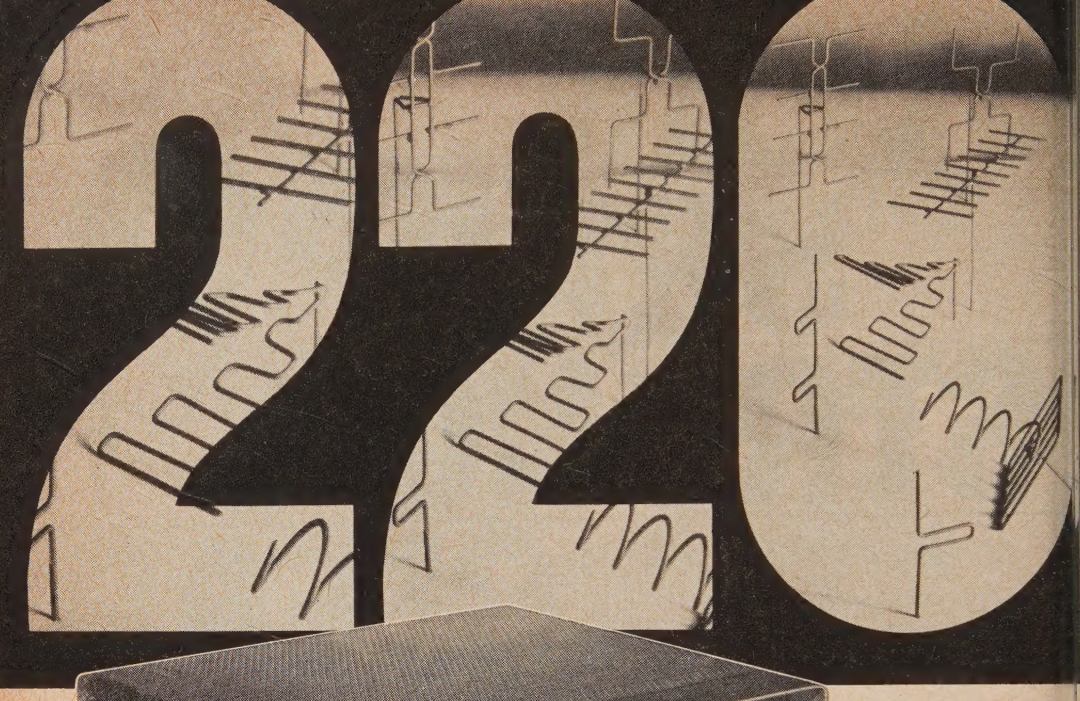
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220 megacycles . . . long regarded as a band of promise . . . where big antenna gain comes easy. A quarter-wave antenna is only a foot long and good ground planes—including the top of a car—are easy to come by. Simple beams and even complex arrays of high gain are conveniently small in size—easy to put together and get up into the air. Here's a band where antenna experimentation can run rampant. Multi-element yagi's . . . stacked colinears . . . sleeve types . . . bedsprings . . . log-periodic types . . helicals. The band has DX possibilities too. Remember KH6UK to W6NLZ?

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ZERO BIAS

In the August, 1960 issue of *CQ*[1], an article made mention of the possible advantages that could be found in the establishment of a national calling frequency, whose primary use would be the facilitation of traffic transfer on a twenty-four hour basis. At this time, *CQ* feels an urgent need for such a set-up, and we would like to see the entire fraternity aiming toward bringing one about.

A national calling frequency is one on which no traffic is permitted to take place. In essence, it is a constantly clear channel which is always kept open to provide quick one-way calls, emergency calls, etc. For example, let us imagine that 7150 kc were established as the national calling frequency. No QSOs would ever take place on this exact frequency. Instead, an amateur looking for a QSO would transmit on 7150, call CQ and end his transmission by announcing the frequency or frequencies he will be monitoring. In other words, a typical call on 7150 kc might be:

CQ CQ DE W2VRC QSX 7138 K

The call is brief and to the point. Because the national calling frequency is in existence, other amateurs looking for a QSO will naturally be monitoring 7150 kc for just such a call.

A major step in setting up the national calling frequency is the allocation of certain portions of each hour, during which the national calling frequency must be kept clear for emergency calls. Let's say, for instance, twice each hour for five minutes, on the hour and half hour. That would mean no traffic takes place from 2100 to 2105 hours and from 2130 to 2135, except urgent distress messages. The advantages here are obvious. A distress message will be sent on a frequency where there is a far greater likelihood of it being heard than on any other single frequency. Because of the use of the national calling frequency, the national calling frequency will be the single, most-monitored frequency on the band.

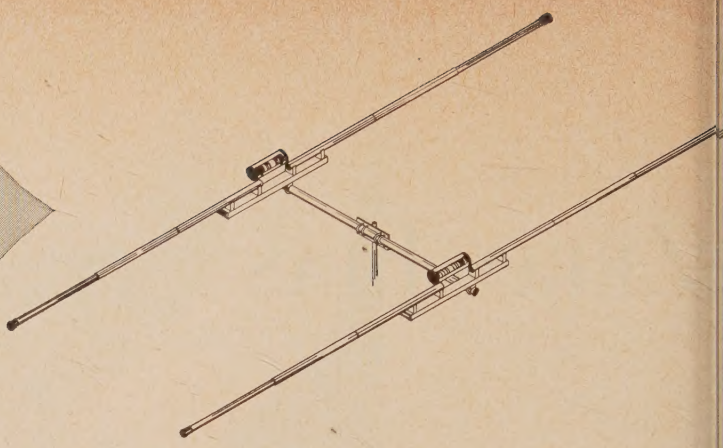
The idea of a national calling frequency is by no means original. It has been used for years by international maritime operators on 500 kc with great success. The three minute silence periods allow weak emergency calls to be heard, that would not otherwise break through the QRM. Picture the advantages, not only for distress calls, but for spotting rare DX or unexpected band openings.

Only through cooperation of members of the amateur ranks could the national calling frequency become an effective reality. We, as amateurs, use our frequencies not by right, but as distinct privileges granted by the F.C.C. The national calling frequency would be a great step toward indicating mature use of these privileges and may well result in widespread prestige for amateur radio.

The ideal situation would be a single frequency within each amateur band, frequencies not too close to a band edge and easy to check with the crystal calibrator. Naturally, only time and experience will dictate the best spots of the national calling frequency and the best techniques. If it is to come about it must begin somewhere. We firmly believe that amateur radio is ready for this new step forward.

[1] Erwin, R. J., "The New Concept In Traffic Networks," *CQ*, Aug. 1960, p. 45.

It's The GREATEST!



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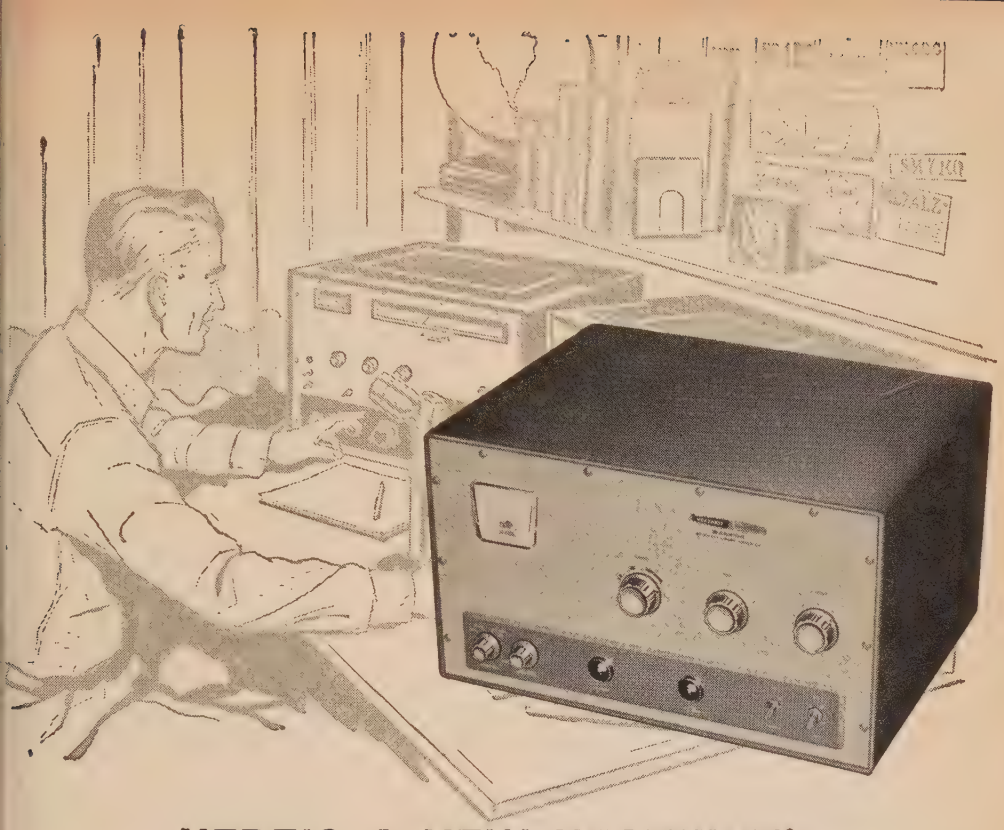

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inside view shows the neat circuit layout husky components that emphasize quality. the internal shielding of plate circuit for mum protection against TVI.

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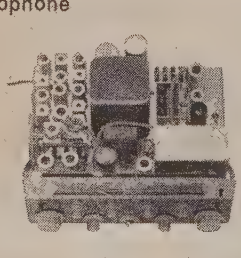

new transceivers for 6 & 2 meter nomads

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"Mobile" or "Fixed", the new "Shawnee" 6-meter "Pawnee" 2-meter transceivers bring you unprecede performance, for each is a complete AM & CW Tra mitter/Receiver combination with features unmatched this price . . . just connect an antenna and you are in bu ness! Transmitters feature a *built-in VFO* with all f quency determining components mounted on a "heat sir plate for temperature stability and *four* switch-selec crystal positions for novice, CAP, MARS or net operati VFO and all exciter stages are tracked for conveni *single knob tuning* over any 500 kc band segment (gre excursions require simple re-peaking of final). A V "spotting" switch is provided to "zero in" signals w transmitter off-the-air. The 6360 dual-tetrode final amplifier provides 10 watts of power *output* to the ante and a built-in *low pass filter* is incorporated to supp harmonics and other spurious radiation. The *dual-purp modulator* provides a full 10 watts of audio for high le plate modulation of the final RF amplifier or 15 watts audio for paging or public address use, selectable with pu pull switch. Superheterodyne receivers feature double c version with first oscillator crystal-controlled. All oscillat are voltage regulated for stability. A large slide-rule and vernier tuning provide more than ample bandspr for both receiver and VFO. RF gain, BFO, ANL, Squel AVC on/off and transmitter controls are front pa mounted. *Tuning meter* is automatically switched to r signal strength or relative power output. Units come co plete with built-in speaker, heavy duty AC & DC po cables, primary fused relay, adjustable mounting brac and push-to-talk ceramic element microphone with cord & mounting clip. 6" H x 12" W x 10" D. 34 lbs. ea

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Model HW-30 (2 meter)...$4.50 dn., $5 mo.....**$44.95**

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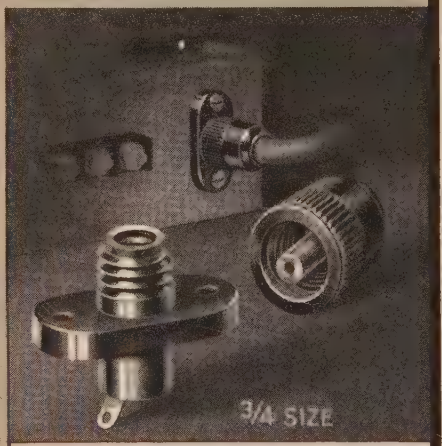

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An old favorite in the line of exclusive Millen "Designed for Application" products. Combination high voltage terminal and thru-bushing. Tapered contact pin fits firmly into conical socket providing large area, low resistance connection. Pin is swivel mounted in cap to prevent twisting of lead wire. Easy to use. ¼" o.d. insulation high voltage cable fits into opening in cap. Bared conductor passes thru pin for easy soldering to pre-tinned tip of contact plug.

Standard 37001 available in either black or red bakelite. No. 37501 is low loss mica filled yellow bakelite for R.F. applications.

JAMES MILLEN MFG. CO., INC.

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ANNOUNCING

Dayton Hamvention

Once again the D.A.R.A. announces their 1961 Hamvention to be held April 29, 1961 at the Dayton Biltmore Hotel, Dayton, Ohio. Highlighting the hamvention will be the presentation of a Johnson Invader-2000 plus prizes worth in excess of $5,500.00. The usual forms on v.h.f., DX, s.s.b. and RTTY, as well as an open hospitality room, will be open for rag chews and get-togethers. Some of the more prominent DX clubs will be there entertaining well known DX visiting the hamvention. Technical programs are also included, from 9 A.M. to 5 P.M. Exhibit booths of leading manufacturers and distributors will also be on display. Attendance will undoubtedly exceed last years crowd and everyone is encouraged to make their reservations early. Jack Sargent, K8BSM will give you all the scoop if you write to him at 3415 Blocker Drive, Dayton 20, Ohio.

Tampa V.h.f. Association

The Tampa Bay V.h.f. Association will hold its Annual Hamvention Saturday April 22 in Tampa. This V.H.F. Hamvention, to which more than 3,500 amateur operators throughout the state of Florida are being invited, will be held at the Fort Homer Hesterly Armory.

V.h.f. Equipment Display: 9:30 A.M. 'til 10:30 P.M. 150 Manufacturers expected. Two stations will be in operation. Banquet at 7:30 P.M. Contact Milt Faivre, K4EBT, at the TAMPA BAY V.h.f. ASSOCIATION, P.O. BOX 1862, Tampa 1, Florida, for further details.

The Tin Lizzy Club

The Ford Amateur Radio League is proud to announce the "Tin Lizzy Award," a certificate of high esteem entitling the recipient to a lifetime membership in the Merit Society of the Ford Amateur Radio League.

The F.A.R.L. will be pleased to award this attractive certificate as follows:

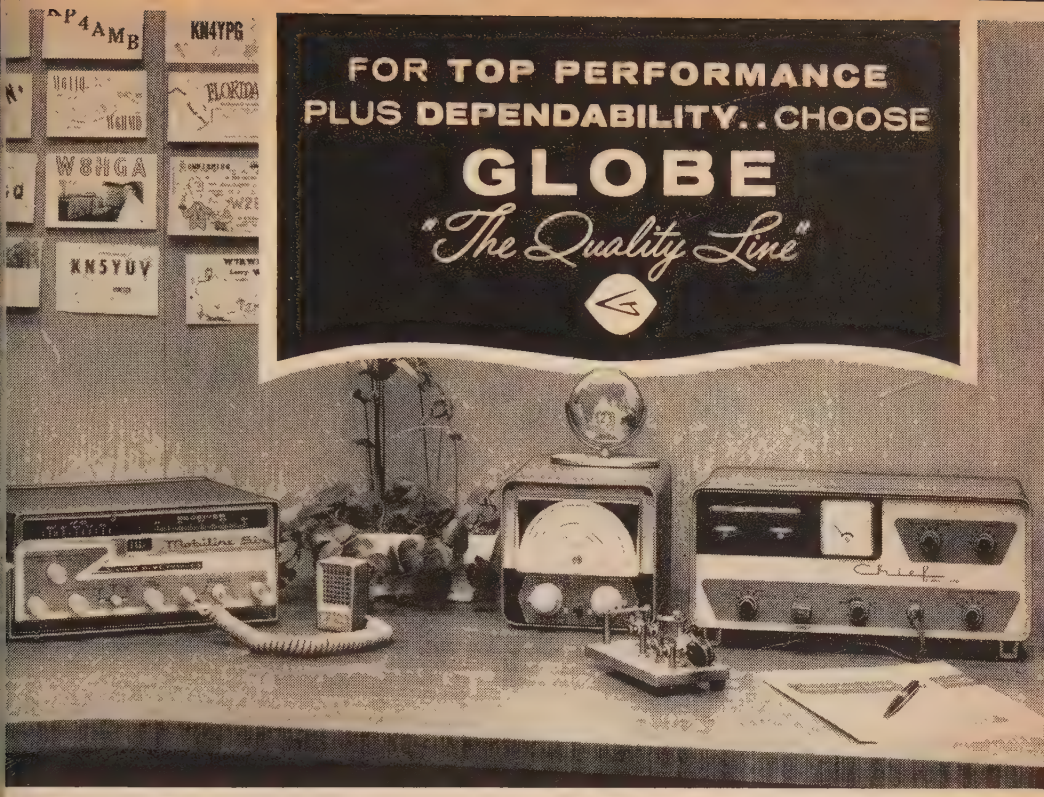
The General Award: Five QSL'd contacts with separate F.A.R.L. member stations: *The Novice Award:* Three QSL'd contacts with separate F.A.R.L. member stations; *The V.h.f. Award* (50 mc and above): Three QSL'd contacts with separate F.A.R.L. member stations; *The S.w.l. Award:* The exchange of QSL's in accord with any of the above groups will merit this award; *DX Award:* Three QSL'd contacts with separate F.A.R.L. members.

Application for the award must be made to: Ford Motor Company, Ford Amateur Radio League, K8UTT, Corresponding Secretary, c/o the Recreation Unit, Building "G", 3001 Miller Road, Dearborn, Michigan.

The letter of request must include a resumé of the required QSL'd contacts, listing the pertinent logging information of each to facilitate verification by the Corresponding secretary. The requestee should include a blank QSL card for F.A.R.L. information and filing. There are no handling charges.

The following list of Ford Amateur Radio League Member-Stations will constitute credit for the "Tin Lizzy Award." This list is subject to revision.
W8BVC, INC, IYY, KNP, KXO, PCR, PEF, QFR, RDL, RYG, TEY, WNX, YEL; K8ADF, CRD, DDX,

◀ For further information, check number 10, on page



OUTSTANDING 6-METER MOBILE OR FIXED STATION PERFORMANCE
TEAMED WITH MULTI-BAND VERSATILITY FOR CW OPERATORS

Globe Mobiline Six

COMPLETE 6-METER TRANSCEIVER

For mobile or home use with either crystal or VFO control. Compact unit mounts under dash. VFO is voltage regulated and assembled on heavy mounting plate, completely shielded and physically isolated from main chassis. Maintains stability even on rough roads. Crystal control also available for NET, CD or MARS operation. Receiver sensitivity is 1 mv or better. Transmitter input, 20 watts. Features universal power supply for either 6 or 12 V DC and 115 V AC. Merely change power plugs supplied for mobile or fixed station operation. Power requirements approx. 100 w. Size: 5″ x 12″ x 12″. Wt. 20 lbs.

Less microphone **$249.95**

Globe Chief Deluxe

90W • 10-80 METER CW TRANSMITTER

New self-contained 90w transmitter for CW bandswitching 10-80M. 75w meter indication for novice use. New 1300 MMFD variable loading condenser. Modified grid block keying for maximum safety (cathode keying with VFO). No Modification necessary to add Globe VFO or modulators. Built-in power supply. Standard coaxial antenna fittings. Rotary switches throughout. Three-color diagrams simplify kit construction. Kit contains prepunched chassis, all parts and tubes, and complete manual.

Wired, $79.95 **Kit, $59.95**

GLOBE VFO-755A

Comes complete with well-filtered power supply with voltage regulation. Output on 40 and 160M. Vernier Drive, 13:1 tuning ratio. Approx. 50 RF volts output. Temperature compensated for utmost stability for AM and CW. Calibrated 10M-160M.

Wired, $59.95

Most Distributors Offer Terms of 10% Down and Easy Pay Plans

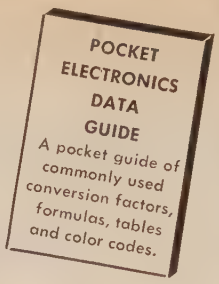
IMMEDIATE DELIVERY. See your local distributor or write direct to

GLOBE ELECTRONICS

A DIVISION OF TEXTRON ELECTRONICS, INC.
22-30 SOUTH 34TH ST. COUNCIL BLUFFS, IA.

For further information, check number 11, on page 126

Get This Handy POCKET ELECTRONICS DATA GUIDE



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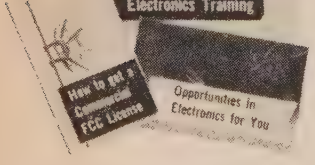

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Please send Free Booklets prepared to help me get ahead in Electronics and a free copy of your "Pocket Electronics Data Guide." I have had training or experience in Electronics as indicated below:

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☐ Radio-TV Servicing
☐ Manufacturing
☐ Amateur Radio
☐ Broadcasting
☐ Home experimenting
☐ Telephone Company
☐ Others

In what kind of work are you now interested?. . .....

In what branch of Electronics are you interested? ... .

Name ..... Age .....
Address. .....
City... ..... Zone .... State .....

CQ 75

EFW, EMJ, EQL, EWH, EWI, GMX, GPT, GSA; K8HSQ, IPR, IQF, JEL, JXW, JYS, KCO, LIB, LJK, LKA, LTU, LUU, LWP, MDR, NOU, ODK, ODX, OJE, PCD, PGJ, PIQ, QJL, RWL, SGH, TKK, UTT, UBV, and W4HXC.

Rock Creek Home Brew Contest

The Rock Creek Amateur Radio Association is sponsoring a "home-built" contest for Novices. At present, this contest is limited to the local area. However, they believe that this contest will be of interest to other clubs as a possible project which they might undertake to further the art of "building-your-own" equipment. Contact W3BNE, at 13012 Turkey Branch Parkway, Rockville Maryland, for more info.

Microwave Society of Long Beach, Calif.

The Microwave Society of Long Beach is a new club and was organized January 11th of this year. It boasts already of a membership of 24 members. The policy of this group is to study and develop equipment for the v.h.f., u.h.f., and microwave frequencies. It is the plan of the club to assist the radio amateur not too familiar in this field. Group building projects have been formulated and it is expected that many fine pieces of gear will be turned out. Radio amateurs interested are invited to join this growing group which meets every 2nd Wednesday of each month at 8 P.M. at the Bayshore Public Library, 2nd Street and Bayshore Ave., Long Beach, California.

Hillsborough A.R.C.

We would like to announce that an intensified effort to assist and amplify the present Public and Emergency Communications Service in Hillsborough County (Florida) area is being made by the newly organized Society known as "HARS" Hillsborough Amateur Radio Society, Inc., a non-profit organization.

The objects of the Society are:

1. Dedication to the Public Service and cooperation with any and all recognized local and governmental agencies and amateur radio organizations in time of emergency where communications are required.
2. To promote a spirit of friendliness and coöperation among amateur radio operators, beginners, and other amateur radio clubs. Also, to promote an interest in amateur radio.
3. The Society will be used as a medium for the exchange of ideas, procedures, practices and for the advancement of the art and the enjoyment of amateur radio.

The Society will also work in cooperation with RACES, AREC, Red Cross, and Civil Defense organizations in the Hillsborough County Area. W4UHF is vice president and can be found at 5512 N. Armenia Ave., Tampa 3, Florida.

New Mexico Field Day

In the past, the 4-Corner Field Day has received a great reception from the Amateur Society; we expect a whing-dang-dilly this year.

What it is, is this: Members of the Totah Amateur Radio Club will make a trip (with equipment) to the four-state corner of the U.S.A. on May 27, 28, 1961, the only place in the nation common to three call areas. Amateurs working a club member from 4-corner are eligible for the "5Ø7" Award, upon our receiving their confirmation of the contact (as checked against our log.)

Morris Miller, W5YDN, is the Sec. Treas. of the club and can be found via Box 24, Farmington, New Mexico.

Central Kansas Radio Club

Sunday, June 4th, will mark the 14th Annual CKRC Hamfest, to be held in Kenwood Park at Salina, Kansas. Registration will begin at 9:00 A.M. for the 1:30 P.M. prize drawing. Although everyone is welcome, only licensed hams and their YL or XYL are eligible for registration. Bring a covered dish and silver service for your own family! This is the one everyone comes to! Registration fee is $1.00. For further information contact; Dave Miller, KØRJL, 721 Morningside Drive, Salina, Kansas.

hy-gain Hy-Line

MULTIBAND DOUBLETS*

FOR 40 AND 80M, 6 THRU 80M, 6 THRU 40M, 6 THRU 20M

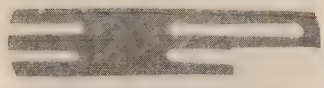
NO TRAPS

*Patent Pending

Through the use of a unique and exclusive new patented process, a multiplicity of doublet wires are extruded in a perforated, low loss polyethylene ribbon. ELIMINATING TRAPS, the Hy-Line doublets maintain high efficiency, full size performance on all bands with an SWR of less than 2:1. May be fed directly with 52 or 72 ohm coaxial cable. No matching sections, baluns, or antenna tuners required. All doublets handle maximum legal power, 1,000 watts CW or AM, 2,000 watts SSB. Completely factory pretuned, ready to (unroll and) install in a matter of minutes. Each doublet includes new molded unbreakable center and end insulator assemblies.

40 and 80 Meters

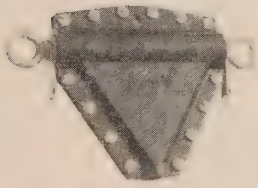
The perfect companion to your high frequency beam! Super full size efficiency and excellent broad band characteristics on 40 and 80 meters made possible by stagger tuning principle. Actually four individual extruded line doublets (two on 40 meters and two on 80 meters) in simultaneous use maintaining low SWR and best possible band pass. Complete with center and end insulators (less feedline), net weight only 4¾ pounds. Overall length 130'.



MODEL NO. 2-BD **$34.95**

6, 10, 15, 20, 40 and 80 Meters

At last a highly efficient all-band doublet that operates as well on the high frequencies as it does on 40 and 80 meters. Overall length 130'. Net weight only 5 pounds. Complete with new molded plastic center and end insulators.



MODEL NO. 6-BD **$37.50**

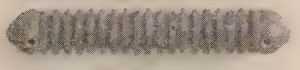
6, 10, 15, 20 and 40 Meters

For the ham who doesn't have space for the 80 meter section, 6 through 40 meter coverage in an overall length of 64'. Complete with new molded plastic center and end insulators. Net weight only 3½ pounds.

MODEL NO. 5-BD **$29.95**

6, 10 15 and 20 Meters

Only 32' long! Installs almost anywhere - rooftops, attics, etc. Excellent for portable or temporary operation. Rolls up into a small package for easy handling and transportation. Complete with new molded plastic center and end insulators. Net weight only 2¾ pounds.



MODEL NO. 4-BD **$21.95**

Center Insulator

Supplied in all Hy-Line Doublets, the new center insulator is also available separately. Molded of high impact cycolac plastic with all hardware iridite treated in accordance with military specifications. Furnished with silicone grease for weather proofing. Accepts either ¼" or ⅜" diameter coaxial cables. Weight only 6 oz.

MODEL NO. CI **$3.95**

End Insulator

Supplied in all Hy-Line Doublets, the new 7" end insulator is molded of high impact cycolac plastic with aluminum bushings. Heavy serrations increase leakage path to approximately 12". Weight only 2½ ounces.

MODEL NO. EI **$1.00**

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1135 NO. 22nd ST.
LINCOLN, NEBRASKA

"The World's Largest Manufacturer of Amateur Communication Antennas"

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WRITE FOR DETAILS

For further information, check number 13, on page 126

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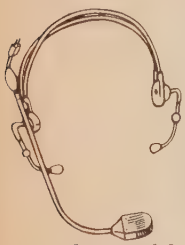
FIDELITY . . . FOR HAMS WITH A LIKING FOR LIGHTNESS



LIGHT . . .

Boom Mike Headset—Light 4 oz. parallel connected receivers transmit sound directly to ears through adjustable tone arms. Rubber or plastic tips block background noise without pressure, allowing continuous communication under the most difficult conditions. Available with a wide choice of general or special purpose microphones. Mike boom, angled for best pickup, has 360° swivel. Ideal headset for mobile use. Impedance: 500 ohms. Frequency response: 50 to 5000 cps. Sensitivity: 114 db above .0002 dynes per sq. cm. for 1 milliwatt input.

LIGHTER . . .

Twinset—FAA approved, the 1.6 oz. Twinset is standard on airlines; fits any amateur, experimental or commercial installation. The lightest twin magnetic receiver headset ever made! Sound is piped through adjustable tone arm. Eartips block out background without touching ears. Standard 5′ cord and phone plug or optional cord with volume control. Frequency response: 50 to 5000 cps. Sensitivity: 101 db above .0002 dynes per sq. cm. for 10 microwatts input.

STILL LIGHTER . . .

Monoset—Under-chin 1.1 oz. set features removable eartips, optional volume controls. Durable aluminum construction, Monoset has 5′ cord and standard plug. Frequency response: 100 to 5000 cps. Sensitivity: 88 db above .0002 dynes per sq. cm. for 10 microwatts input.

LIGHTEST . . .

Tele-Fi—True dimensional sound and 30% better understanding with this ½ oz. set because of a 1 millisecond delay in sound reaching ear opposite receiver. Replaceable ear tips. Change from headset to accessory earset in seconds. Standard phone plug and 5′ cord included. Tele-Fi chin band usable with all TELEX transistor receivers. Frequency response: 50 to 5000 cps. Sensitivity: Comfortable at 1 milliwatt.

See your jobber today for superior quality communications accessories . . . by TELEX*! Or, write for information to:*

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Communications Accessories Division

Dept. CA-307, Telex Park, St. Paul 1, Minnesota

For further information, check number 14, on page 126

WØ-DXCC 5th Annual Convention

On April 15, 1961 the WØ-DXCC Roundup will be held at the Holiday Inn, Fluer Drive and Grays Lake in Des Moines, Iowa. One P.M. is the starting time and it should be quite a DX get-together.

Some of the DX personalities that will be attending are: Ian. MP4BBW with his stories of Persian Gulf; WØAIW and the crew that operated VQ9A; A1, XE1H who will probably narrate the trip to XE4B, and slides from 9N1SM. Pre-registration is $5.00 and $5.50 at the desk. Gene Heck, WØBSK is handling the reservations. He can be found at 3678 E. 8th St., Des Moines, Iowa.

Fresno A.R.C.

The Fresno Hamfest will be held on Saturday, May 6, 1961, at the Towne and Country Lodge at Fresno. Registration starts at 8:00 A.M. and activities start at 10:00 A.M. There will be technical talks and demonstrations including u.h.f and s.s.b., a swap table, mobile field intensity measurements, hidden transmitter hunts, and ladies luncheon and special entertainment. Banquet will be at 7:00 P.M. and is included in the registration fee of $5.50. Reservations should be made for the Hamfest through Fresno Amateur Radio Club, Inc., P.O. Box 783, Fresno, California and room reservations should be made direct with Towne and Country Lodge, 3093 North Freeway 99, Fresno, California.

Delta Division

The Delta Division Convention which will be held at the Read House in Chattanooga Tennessee, April 8th 1961 will feature as its great speaker Dr. Wernher von Braun. The convention is expected to draw a high crowd and the usual exhibits, technical talks, and discussion groups are included. Bert Osborne, W4MF is handling the incidentals.

Costa Rica

From Humberto Perez, TI2HP, we have received the good news that Costa Rica has amended their public law No. 1758 to allow foreign radio amateurs the privilege of operating in Costa Rica. In order to qualify for a license, the county of origin of the visiting amateur must offer the same privileges to Costa Rican amateurs.

Armed Forces Day—Open House

On Armed Forces Day, May 20, 1961, the combined Naval activities of the Naval Supply Depot, Mechanicsburg, Pennsylvania will hold open house from 1300 to 1900 hours (GMT). One of the features will be an Amateur Radio exhibit operated by amateurs employed on the base using the call W3OGD/3. Operations will be on 80 (c.w., RTTY), 75 phone, 40, 15, 6 and 2 phone. A special QSL will be sent for all Armed Forces Day contacts. A cordial invitaion is extended to all amateurs and friends to attend in person or by radio contact.

Birmingham A.R.C.

The Birmingham, Alabama Amateur Radio Club, Inc. is sponsoring their Eighth Annual Hamfest which will be held on May 6th and 7th 1961. The main event will be held at the Alabama State Fairgrounds on Sunday, May 7th. Bill Barkston. W4DFE will fill you in on all the pertinent information. His address is, P.O. Box 603, Birmingham, Alabama.

A recent meeting of the Free State Amateur Radio Club of Fort George G. Meade, Maryland resulted in the election of officer's for 1961. The new officers are: W3ENU, President; K2MAX, Vice President; WV6LLD, Secretary; W7RAK, Treasurer; W3HCE, Supply Officer; K3IYT & W3OSF, Executive Committee. The outgoing President is W3NNM.

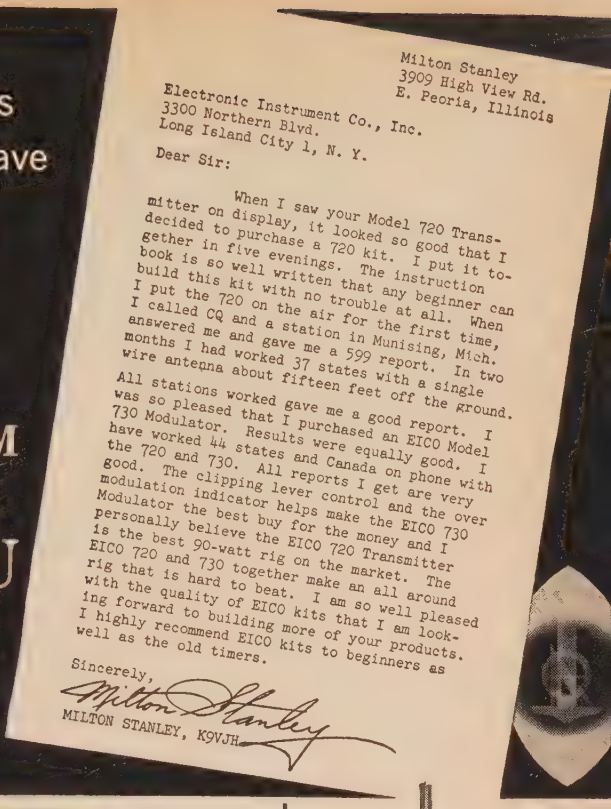
Correction

Sawtooth Sweep For Modulation Monitor Scope, February, 1961, page 34. To prolong the life of the 2D21, in figs. 1 and 2, add a 50 ohm surge limiting resistor in series with pin 6, the plate.

To the hundreds of Hams who have taken the time to write, we at EICO can only say...

FROM THE BOTTOM OF OUR HEARTS, THANK YOU

We promise to continue to do all in our power to merit your approval.



Milton Stanley
3909 High View Rd.
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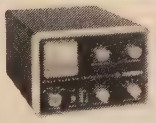
Electronic Instrument Co., Inc.
3300 Northern Blvd.
Long Island City 1, N. Y.

Dear Sir:

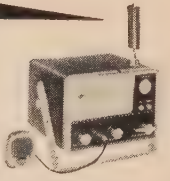
When I saw your Model 720 Transmitter on display, it looked so good that I decided to purchase a 720 kit. I put it together in five evenings. The instruction book is so well written that any beginner can build this kit with no trouble at all. When I put the 720 on the air for the first time, I called CQ and a station in Munising, Mich. answered me and gave me a 599 report. In two months I had worked 37 states with a single wire antenna about fifteen feet off the ground. All stations worked gave me a good report. I was so pleased that I purchased an EICO Model 730 Modulator. Results were equally good. I have worked 44 states and Canada on phone with the 720 and 730. All reports I get are very good. The clipping lever control and the over modulation indicator helps make the EICO 730 Modulator the best buy for the money and I personally believe the EICO 720 Transmitter is the best 90-watt rig on the market. The EICO 720 and 730 together make an all around rig that is hard to beat. I am so well pleased with the quality of EICO kits that I am looking forward to building more of your products. I highly recommend EICO kits to beginners as well as the old timers.

Sincerely,
Milton Stanley
MILTON STANLEY, K9VJH

90-WATT CW TRANSMITTER* #720
Kit $79.95
Wired $119.95
*U. S. Pat. No. D-184,776
"Top quality" — ELECTRONIC KITS GUIDE. Ideal for veteran or novice. 90W CW, 65W external plate modulation. 80 through 10 meters.



NEW! 60-WATT CW TRANSMITTER #723
Kit $49.95
Wired $79.95
Ideal for novice or advanced ham needing low-power, stand-by rig. 60W CW, 50W external plate modulation. 80 through 10 meters.



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Single and Multi Channel Models Available.
From Kit $59.95 . Wired $89.95

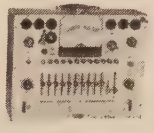
HIGH-LEVEL UNIVERSAL MODULATOR-DRIVER #730
Kit $49.95 Wired $79.95
Delivers 50W undistorted audio. Modulates transmitters having RF inputs up to 100W. Unique over-modulation indicator. Cover E-5 $4.50.

GRID DIP METER #710
Kit $29.95 Wired $49.95
Includes complete set of coils for full band coverage. Continuous coverage 400 kc to 250 mc. 500 ua meter.

PEAK-TO-PEAK VTVM #232 & *UNI-PROBE®
Kit $29.95
Wired $49.95
VACUUM TUBE VOLTMETER #221
Kit $25.95 Wired $39.95

*U. S. Pat. No. 2,790,051

COLOR & MONO DC-5MC LAB & TV 5" OSCILLOSCOPE #460
Wired $129.50
Kit $79.95
5" PUSH-PULL OSCILLOSCOPE #425 Kit $44.95 Wired $79.95



DYNAMIC CONDUCTANCE TUBE & TRANSISTOR TESTER #666
Kit $69.95 Wired $109.95
TUBE TESTER #625
Kit $34.95 Wired $49.95

RF SIGNAL GENERATOR #324 (150kc-435mc)
Kit $26.95
Wired $39.95
TV-FM SWEEP GENERATOR & MARKER #368
Kit $69.95 Wired $119.95

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Add 5% in the West.

ENGINEERS: Excellent career opportunities in creative electronics design. Write to the Chief Engineer.

For further information, check number 15, on page 126

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ACF

ELECTRONICS

COMMUNICATIONS

FIELD STATION ENGINEERS

Qualified engineers will develop a background in Ionospheric Physics and the study of Backscatter Phenomena through a training program in our Hyattsville, Maryland, Electro-Physics Laboratories. Engineers selected will have ample opportunity to develop professionally as part of a team extending experiments of the Research and Development Department to the field in both domestic and overseas assignments.

EE degree or equivalent, consisting of combined civilian or military technical school is required. Experience as a Field or Project Engineer with valid 1st or 2nd class FCC license is essential for senior level positions. A good command of some of the following is most desirable:

Radar; HF Long Distance or Meteor-burst Communications Systems; Scatter Systems; Propagation Prediction; Ionospheric Sounder Operations; RDF Systems; Short Wave (Amateur) Radio.

Interested engineers must be willing to accept assignments in areas where dependents are not permitted for periods up to one year. Differential paid for overseas assignments.

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FIELD SERVICE ENGINEERS

Experienced engineers can enhance their careers in this expanding program by providing professional engineering services on complex electronic and electro-mechanical devices at military installations throughout the United States and overseas.

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Please send resume to: **Mr. Robert J. Reid**
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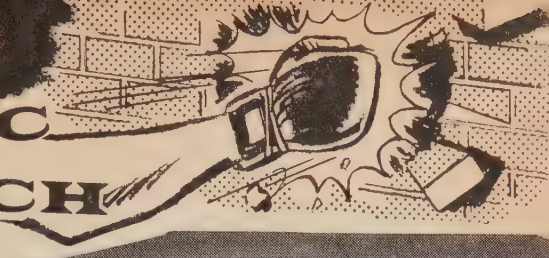

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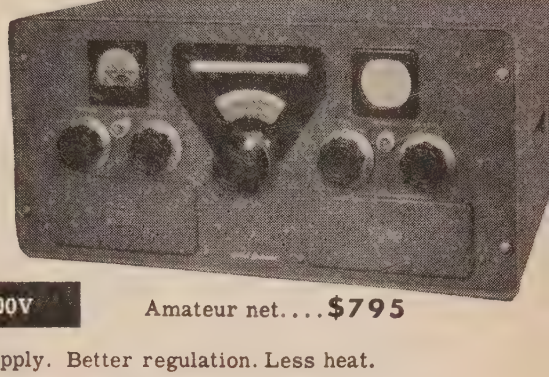

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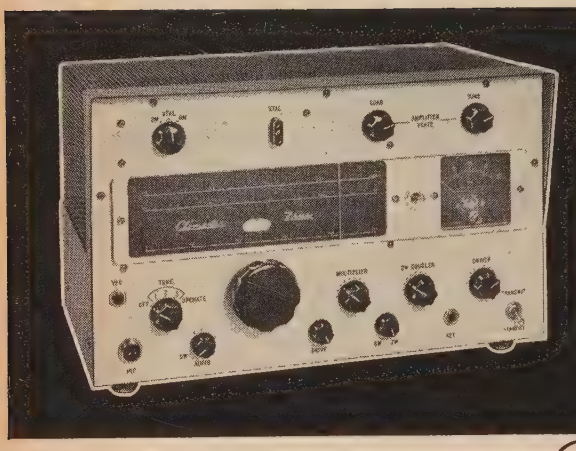

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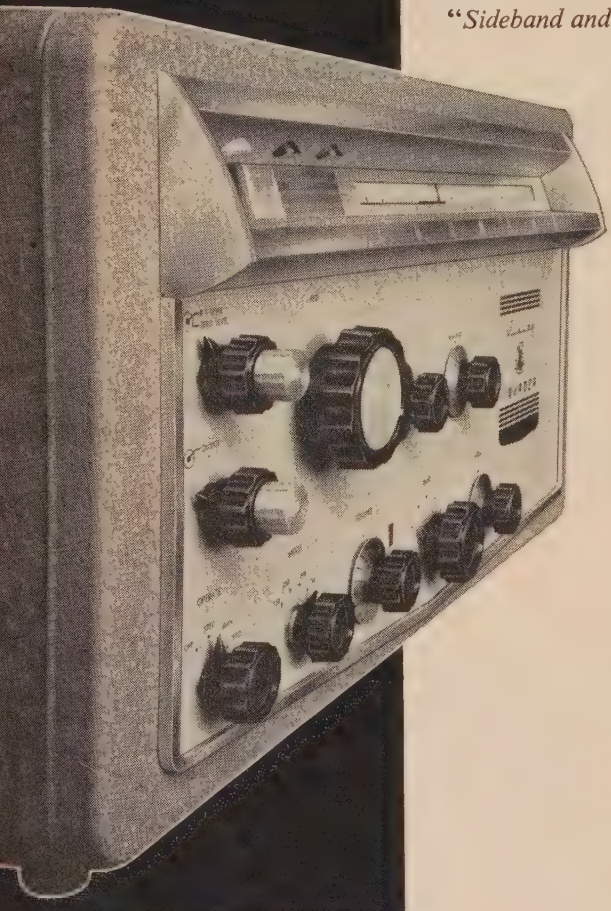

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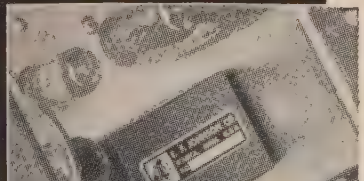

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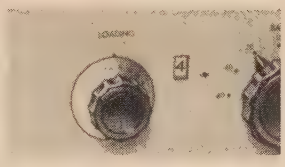

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The Sunspot Story; Cycle 19 The Declining Years

By George Jacobs*, W3ASK and Stanley Leinwoll†

Part I

A little over five years ago, in March of 1956, the PROPAGATION Editor of CQ, W3ASK, published an article in CQ entitled "The Sunspot Story; Cycle 19—Once In a Lifetime Conditions." The article discussed the then approaching solar maximum and its probable influence on reception conditions in the various amateur bands. The author predicted that the peak of the present cycle (Cycle 19) would occur by May, 1958, would be of unprecedented intensity, and would result in shortwave reception conditions far better than ever experienced before in the history of radio.

The peak of the cycle actually occurred during March, 1958 and it was far more intense than any level of solar activity recorded previously. Among other predictions contained in the article, all of which also came to pass between 1957 and 1960, were world-wide DX on six meters, around-the-clock openings on 20 meters, direct reception of European and Latin American TV broadcasts causing interference in the USA, and in general, conditions which occur very seldom, perhaps only once in a lifetime.

With record-breaking solar activity now a matter of history, the present sunspot cycle has started to decline, and it is natural to ask "what now?", and "where do we go from here?". To answer these questions, and to give as complete a picture as possible as to what conditions might be like on the amateur bands in the years ahead, CQ has commissioned W3ASK to collaborate with Stanley Leinwoll on a sequel to the 1956 report. Mr. Leinwoll has contributed several articles to CQ in the past and is the author of a popular book on shortwave propagation[1].

The Jacobs-Leinwoll report is now complete and will appear in three parts. Part I, appearing on the following pages, deals with the ionosphere in general, and how it makes possible shortwave radio communications. Part II, which will appear next month, will discuss sunspots, their general behavior, and their influence on radio propagation conditions. Included in Part II will be a sunspot forecast for the remainder of the present cycle, and for the remainder of the century. Part III, to appear in June, will contain a band-by-band forecast of propagation conditions expected during the next five years, and some suggestions for getting the most out of each band. The article will conclude with a brief look beyond the present cycle, through the remainder of the century.

The Editors of CQ believe that the Jacobs-Leinwoll report is the most comprehensive ever written on the subject of the solar cycle and its influence on reception conditons in the various amateur bands. We believe that it will be of considerable value to all radio amateurs.

Introduction

"WHAT's happened to all the DX that used to be on ten meters? The band is as dead as a doorknob these days."

"The Europeans (or the JAs or South Americans) seem to have disappeared from six meters. All I can work these days are the guys at the other end of town."

"Heck, just a few years ago everything was rolling in on twenty meters just after supper. The band's been so dead these past few months that I'm back to watching TV again!"

"Say, I had the surprise of my life the other night. I tuned down to eighty meters because everything else was dead, and guess what . . . DX was rolling in all over the place—what's happening?"

"With conditions as bad as they are, I wonder if I should buy that fifteen meter beam. Maybe I ought to invest the money in a good low frequency antenna?"

These are but a few of the typical remarks heard these days as one tunes across the various amateur bands. What's happened to the "good" conditions of a few short years ago? Why are conditions so poor now? Are they going to get worse? When are they going to get better again? *These are the questions that this report hopes to answer.*

*PROPAGATION Editor *CQ*, 11307 Clara Street, Silver Spring, Md.
†33 Cranston Road, Franklin Park, New Jersey
[1]*Shortwave Propagation*, Published by J. F. Rider, N. Y.

We plan to answer these questions, and tell the complete sunspot story in three installments. For those of you who may be impatient, however, the following summary may give you some idea of what's taking place.

In A Nutshell

Long-distance radio communication is possible only because of the existence of an electrified region high in the earth's upper atmosphere. This region, electrified by nature, is called the ionosphere. It is the ionosphere, acting somewhat like a mirror, that reflects shortwave radio signals over great distances.

The electrical intensity of the ionosphere (later we'll use the more correct term, ionization), depends upon ultraviolet radiation from the sun. The greater the amount of radiation that sweeps across the ionosphere, the more electrified it is, and the better are shortwave reception conditions. As the level of radiation reaching the ionosphere diminishes, shortwave reception conditions become poorer.

The amount of radiation illuminating the ionosphere varies hourly, seasonally and geographically, depending upon the relationship between the sun and the earth. In addition, year-to-year changes, over an approximate 11-year cycle, occur in the ionosphere's capability to reflect radio waves. These changes result from the difference in the number of sunspots seen on the face of the sun. We'll talk a great deal more about sunspots later in this report. At this point, however, we'll mention that sunspots are dark spots on the sun's surface which seem to give a fairly accurate indication of the general strength of the ionsophere. When the sun's surface is covered with a great number of spots, the ionosphere is electrically strong and shortwave radio conditions are generally very good; when the number of sunspots diminish, conditions become poorer.

During the period 1957-1960, a record breaking number of sunspots appeared on the face of the sun. This resulted in a more intense ionosphere than was ever recorded previously. Shortwave radio conditions, especially on the 20, 15, 10 and 6 meter bands, were exceptionally good. On the other hand, because of conditions that will be explained later in this report, reception on the lower frequency bands (40, 80 and 160 meters) were relatively poor.

The present sunspot cycle, the 19th observed since accurate sunspot records have been kept,[2] reached its record breaking peak during March, 1958. Since then, sunspot activity has been declining . . . slowly at first, but now more rapidly. *This decline is expected to continue until the present cycle reaches its minimum value, sometime during early 1965.*

The decline in the sunspot cycle is responsible for the poorer conditions presently observed on the 20, 15, 10 and 6 meter bands. *Conditions will continue to become poorer on these bands during the next four years as the cycle declines steadily.*

Although the outlook is not bright, it is certainly not bleak either. For reasons that will be explained later in this report, the declining solar cycle will bring about the return of DX life, and relatively good conditions, to the 40, 80 and 160 meter bands. This improvement has already been noted during the hours of darkness, *and conditions will continue to improve steadily on these bands during the next four years.*

There you have it in a nutshell . . . the present sunspot cycle is declining, and will continue to decline for the next four years. This decline will be responsible for steadily poorer conditions on 20, 15 10 and 6 meters, but increasingly improved conditions on 40, 80 and 160 meters.

Since the ionosphere, sunspots, solar radiations, and the like, play such an important role in long-distance shortwave radio communications, it is desirable at this point to go into somewhat greater detail concerning their general behavior so that we can better interpret the changes in shortwave conditions expected during the next five years, or so.

The Ionosphere

In 1901, Marconi successfully completed one of the most historic experiments ever conducted . . . the transmission of a radio signal, without wires, across two thousand miles of ocean.[3]

Prior to Marconi's experiment, it had generally been believed that radio propagation was restricted to line of sight. Furthermore, the German physicist, Heinrich Hertz had demonstrated that radio waves travelled in straight lines, but that their direction of travel could be altered by interposing an electrically conducting obstacle in their path.

A year after Marconi's initial success, two scientists, Arthur Kennelly in the United States, and Oliver Heaviside, in Great Britain, suggested in independent scientific papers[4] that the earth's upper atmosphere consisted of an elec-

[2]Sunspots were sighted visually by the Chinese more than 2000 years ago. Galileo, inventor of the telescope, viewed sunspots for the first time telescopically in 1611. Accurate sunspot records, however, based on daily telescopic observations were not begun until 1749.

[3]Guglielmo Marconi, an Italian scientist, was the first to conceive the idea of a signalling system employing wireless waves. After several successes during the late 1890's, including transmission across the English Channel, Marconi set out to do what, at that time, seemed impossible . . . bridge the Atlantic by wireless. At the town of Poldu, in Cornwall, England he erected a large spark transmitter and an elevated transmitting antenna of his own design. He then sailed to Newfoundland with his two assistants, Kemp and Paget, and set up a receiving station on Signal Hill, near the city of St. Johns. At 12:30 P.M. on December 12, 1901, using a kite-born antenna, three faint clicks were heard in the receiver's earphone; it was the Morse letter "S", the pre-arranged signal being transmitted from Poldu nearly 2,000 miles away. The Atlantic has been bridged by radio!

[4]Heaviside made his visionary comments in the 9th Edition of the *Encyclopedia Britannica* (page 215, Vol. 33; 1902). At about the same time Kennelly's theory appeared in the *Electrical World and Engineering Magazine* (page 473, Vol. 15; 1902).

trically conducting region. It was this region, they theorized, that acted as an obstacle, and deflected Marconi's signals across the Atlantic Ocean. They reasoned that such a region was probably produced by solar radiation, but two decades were to pass before the existence of this region, called the *ether* during the early days of radio, was verified experimentally.

The electrified region was discovered in 1924 by a British scientist, Edward Appleton.[5] He and his co-workers found conclusive evidence of its existence by measuring the angle of arrival of radio signals from a nearby transmitter. The angle of arrival was such that the signals could have arrived from only one direction . . . by reflection from an area in the earth's atmosphere about 100 miles high. Kennelly and Heaviside's visionary theory of twenty-two years earlier had been verified. For his pioneering work in the field of radio wave propagation, Edward Appleton was subsequently Knighted by the British Empire.

In 1925, Briet and Tuve, two American physicists demonstrated the existence of a reflecting region high above the earth's surface in an even more striking manner. By transmitting short bursts of radio energy vertically upwards, they were able to detect, using suitable measuring and receiving equipment, the presence of an echo which had been reflected and returned to earth by the ionosphere.[6]

By determining the time that had elapsed between transmission of the pulse and reflection of the echo, and assuming that the radio wave travelled with the speed of light, they were able to deduce the height of the reflecting medium with considerable accuracy.

Later, by varying the frequency of the transmitted pulses over a wide range they discovered that above a certain *critical frequency* the reflecting region would no longer return the signals to earth.

Extensive studies, using the Briet-Tuve technique, made at several locations throughout the world, soon showed that the critical frequency varied hourly, seasonally, and geographically. This implied strongly that the reflecting layer was under solar influence.

Further evidence linking ionospheric behavior with the characteristics of solar radiation was obtained in 1927 when a sharp decrease in the critical frequency was observed during a total eclipse of the sun. Figure 1 shows graphically how the critical frequency varied as the eclipse progressed.

It was concluded, from this historic experiment, that the primary solar agent responsible

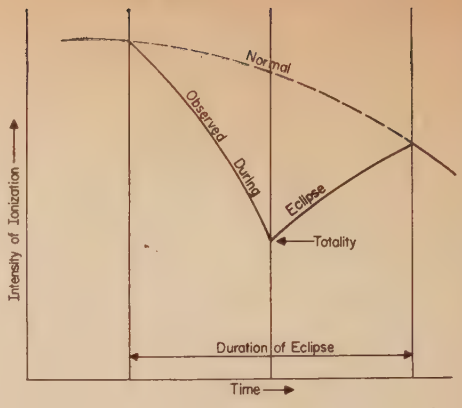

Fig. 1—The moon's shielding effect prevents solar radiation from reaching the earth's atmosphere during a solar eclipse. A sharp decrease in ionization is observed corresponding to the progress of the eclipse.

for forming the ionosphere was ultraviolet radiation, since it is ultraviolet radiation which is cut off during an eclipse. This observation has been verified further during each eclipse of the sun that has occurred since 1927.

Measuring the Ionosphere

The rapid development of long-distance radio communication stimulated intensive investigation of the ionosphere throughout the 1930's. The need to solve newly developing communication problems required the establishment of more modern engineering techniques that would meet the demands of uninterrupted use of the ionosphere for reliable world-wide communication.

Equipped with pulse-sounding equipment, ionospheric measuring stations began to spring up in all areas of the world. From a mere handful in the 1930's, nearly 200 such stations are now charting the ionosphere hourly at more than 40 locations throughout the world.

While the technique is much the same, the equipment used today is far more sophisticated than that used by Briet and Tuve thirty-five years ago. Modern equipment, called *ionosondes*, are fully automatic, and present photographic records of critical frequency. Using methods developed by mathematicians and physicists, it is possible to scale the value of critical frequency for any particular time, and convert it to corresponding values which indicate the electron content of the ionosphere and the height of the reflecting layer above the earth's surface.

Ionospheric information obtained from ionosondes are published regularly by national scientific organizations throughout the world. In the United States, this information is published by the Central Radio Propagation Laboratory (CRPL) of the National Bureau of Standards.[7]

Extensive information concerning the characteristics and structure of the ionosphere has been

[5]The existence of the electrified region was first reported by E. V. Appleton and M. A. F. Barnett in the scientific publication *Nature* (page 334, Vol. 115; 1925). The British Broadcasting Corp. was an early leader in the great expansion and development of the science of long-distance radio communication.

[6]This method for estimating the height of the conducting layer in the earth's atmosphere was first suggested by G. Breit and M. A. Tuve in *Nature* (page 357, Vol. 116; 1925).

[7]*Basic Radio Propagation Predictions, CRPL Series D* and *Ionospheric Data, CRPL Series F*, both published monthly by the Central Radio Propagation Laboratory, NBS, Boulder, Colorado.

gathered over the past thirty-five years by use of pulse probing techniques. In recent years ionospheric measurements made by such techniques have been augmented by measurements made from rockets and earth satellites. Girdling the entire earth several times a day, artificial earth satellites provide the means for extensive investigation of the ionized regions of the upper atmosphere, being able to penetrate deep into areas impossible to reach with ground-based probing equipment.

Formation of the Ionosphere

The earth's upper atmosphere is composed mainly of oxygen and nitrogen, with small amounts of hydrogen, helium, and several other gases. These gases, like all material, are composed of atoms made up of negatively charged electrons assumed to be traveling in orbit about positively charged centers, or nuclei. Atoms, unless they are under the influence of energy forces, are

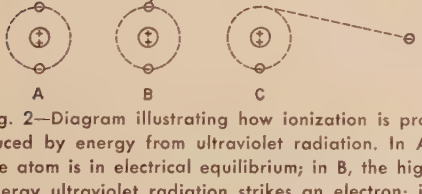

Fig. 2—Diagram illustrating how ionization is produced by energy from ultraviolet radiation. In A, the atom is in electrical equilibrium; in B, the high energy ultraviolet radiation strikes an electron; in C, the free electron is "torn out" of the atom by energy from the ultraviolet radiation. The resulting unbalanced atom is called an ion.

in electrical equilibrium, with the negatively-charged electrons counter-balancing the positive charge of the nucleus (see fig. 2). A neutral atom of this kind exerts no electrical force outside its own structure. An atom remains neutral until subjected to external energy forces great enough to detach electrons from its structure, causing it to become unbalanced, or charged.

Recent data gathered from rocket and satellite probes of the ionosphere have confirmed earlier theories based on solar eclipses that ultraviolet radiation from the sun is the principal agent responsible for the formation of the ionosphere. The great amount of energy associated with this radiation, sweeping through the upper atmosphere, causes electrons to become detached from the gas atoms present. This leaves the originally neutral gas atoms unbalanced, with an excess of positive charge. Such unbalanced atoms are called *ions,* and the process by which they are formed is called *ionization.*

If the ultraviolet energy is removed, the detached electrons recombine with the ions to again form atoms in electrical equilibrium. This process, the opposite of ionization, is called *recombination.* Recombination takes place during the night hours when the ionosphere is cut off from the sun's direct radiation.

It is of interest to note that although ultraviolet radiation from the sun is considered the principal ionizing agent, there is recent evidence indicating that other types of solar radiation, such as X-rays and cosmic rays, may also play a role. Some degree of ionization is also produced by meteors entering the earth's atmosphere.

Structure of the Ionosphere

As ultraviolet radiation sweeps into the earth's atmosphere from above, it first produces ionization of the thin density of air it encounters. As the radiation penetrates deeper into the atmosphere it encounters greater densities of air and the amount of ionization increases. Penetrating further, it produces more and more ionization, but the radiation is also attenuated because it is giving up energy in the ionization process. Finally, the radiation penetrates to a level where its energy is completely dissipated and the ionization processs stops. Thus, there is formed a region of maximum ionization, with intensity falling off, above and below it.

The details of the formation of an ionized region in the earth's atmosphere are shown in fig. 3.

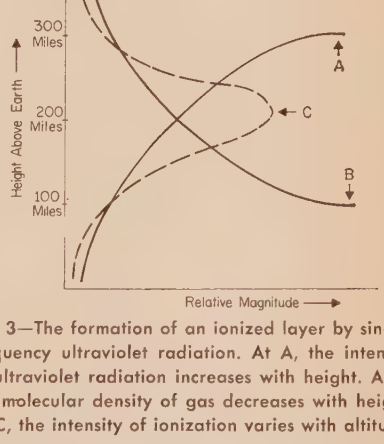

Fig. 3—The formation of an ionized layer by single-frequency ultraviolet radiation. At A, the intensity of ultraviolet radiation increases with height. At B, the molecular density of gas decreases with height. At C, the intensity of ionization varies with altitude.

The range of ultraviolet radiation from the sun comprises a relatively wide band of frequencies. Since the gases comprising the upper atmosphere respond to different frequencies in the ultraviolet spectrum, there is a tendency for ionization to occur at several different levels, or layers, between approximately 30 to beyond 400 miles above the surface of the earth.

While these ionized regions are usually referred to as "layers", they are not completely separated one from the other. Each region, or layer, overlaps to some extent, forming a continuous but non-uniformly ionized area with at least four levels of peak intensity, designated *D, E,* F_1 and F_2.

The allocation of letters to designate the various regions of the ionosphere was initiated by Sir Edward Appleton upon his discovery of the Kennelly-Heaviside layer in 1924. He al-

located the letter *E* to this layer after the symbol generally used to designate an electric vector. In 1925, when he discovered another ionized region at a greater altitude, he used the term *F* to designate the electric vector reflected from it. Shortly later he assigned the letter *D* to the electric vector he found to be reflected from another distinct region located below the *E* layer. This, as he has said, left several letters at the disposal of future workers for allocation to other layers which they might discover either above or below the three layers identified by him. Sir Robert Watson-Watt, an early co-worker of Appleton and one of the original developers of radar, gave the name *ionosphere* to this entire region, and it has been adopted internationally.

The height and characteristics of these layers change from day to night and season to season. Several of these changes are illustrated in fig. 4. A brief description of each layer follows.

The intensity of ionization in the *E* region is considerably greater than in the *D* layer, and follows closely the sun's position in the sky. Maximum ionization occurs near noon when the sun is most directly overhead. As soon as the sun sets, almost complete recombination takes place, and the *E* layer practically disappears during the hours of darkness.

The *F* Layers

The *F* layers are the most important regions of the ionosphere insofar as long-distance short-wave radio communication is concerned. During the daylight hours, there are *two* well-defined regions: the F_1 layer, which begins slightly above the upper boundary of the *E* layer at about 90 miles, and extends up to about 150 miles, and the F_2 layer, whose height varies seasonally, ranging up to about 200 miles during the winter and close to 300 miles during the summer.

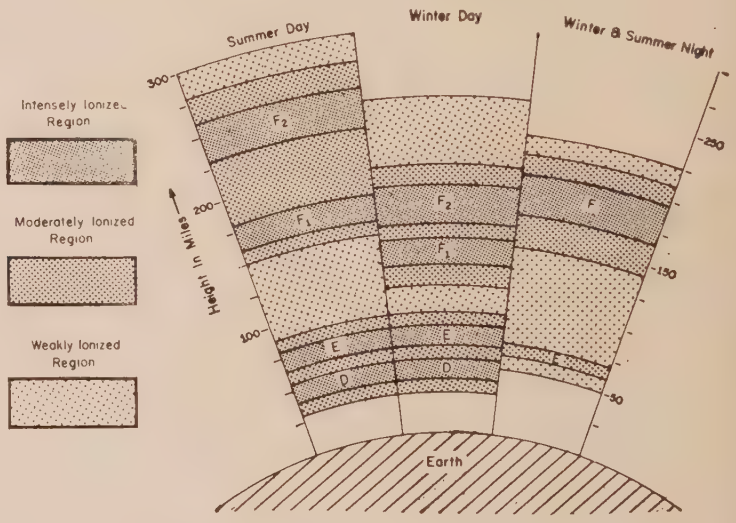

Fig. 4 — Daily and seasonal variations in the ionospheric regions.

The *D* Layer

The *D* layer is the lowest region of pronounced ionization. It extends from about 30 to 55 miles above the earth's surface and exists mainly during the daylight hours. Although it is the ionized region nearest the earth, there is less presently known about it than any other region of the ionosphere.

The amount of ionization in this region is very low compared to the other layers. It reaches maximum intensity at noon when the sun is highest in the sky, and disappears almost completely shortly after sunset.

The *E* Layer

The upper boundary of the *D* layer blends into another distinct region called the *E* layer which occurs mainly during the daylight hours at heights between 50 and 90 miles. While the height of the *E* layer may vary somewhat from season to season, it remains practically constant throughout the day.

Although more intensely ionized, the F_1 layer behaves very much like the *E* layer. Maximum ionization occurs near noon when the sun is more directly overhead, and the layer disappears during the hours of darkness.

Unlike the other layers, ionization in the F_2 region *exists at all times*. This region is the most highly ionized of the ionospheric layers.

During the nighttime hours, the F_2 layer height varies approximately between 150 and 250 miles. Because the recombination rate in this region is slow, the layer exists around the clock. Were it not for this fact, long-distance shortwave radio communication would be virtually impossible during the hours of darkness.

The intensity of ionization in the F_2 region is in an almost continuous state of flux, with hourly, seasonal, geographical and cyclical changes taking place in a somewhat complicated manner. These variations will be discussed at greater length later in this report.

The Sporadic-*E* Layer

In addition to the regular *D*, *E* and *F* regions of the ionosphere, there exists an ionized region which occurs sporadically. Unlike the regular layers, it comes and goes erratically, and its causes are not yet fully known. The height of the layer is variable, but is most commonly found about 60 miles high. Since this is about the same height as the regular *E* layer, it is called the sporadic-*E* layer.

Sporadic-*E* occurs most often during the daylight hours of the summer months, but it has also been observed fairly frequently at night and during the winter. It appears generally as a very intensely ionized, thin region, less than half a mile in thickness and of very limited geographical extent. A typical sporadic-*E* cloud might be 50 to 100 miles in diameter, lasting for several hours before dissipating.

Many sporadic-*E* clouds drift with velocities as great as a few hundred miles an hour. In the northern hemisphere, the drift is usually in a westerly direction.

What produces sporadic-*E* ionization is not yet known. It is believed at the present time that solar radiation, and perhaps meteors, play an important role in its formation. The occurrence of sporadic-*E* ionization, especially during the winter, is often associated with auroral displays.

Sporadic-*E* ionization is of considerable practical importance to radio amateurs since it will often support communications on frequencies considerably higher than those being reflected by the regular layers.

Above the *F* Region

Until the launching of the first earth satellite in the fall of 1957, little was known of the earth's atmosphere above the *F* region. It was generally believed that if any ionization existed at all above this level, its density would be much too weak to be of any significance to radio communications.

With the recent spectacular development of earth satellites and deep space probes, the region, extending beyond the *F* region, and out into interplanetary space is now under extensive investigation. Results already obtained strongly suggest that the earth's atmosphere extends far beyond the level where previously it had been thought to "end" and that ionization, at least to a very small degree, may fill much of the space between the earth and the sun.

It is yet much too early to assess the significance of recent discoveries that ionization exists far beyond the *F* region. It is conceivable that this interplanetary ionization may play a role of great significance in shortwave communications. Only time and more data will yield the knowledge necessary to determine what this role might be.

Regular Ionospheric Variations

Since the existence of the ionosphere depends on solar radiation, it is evident that changes in the position of the earth with respect to the sun (rotation and revolution), as well as changes in the patterns of solar radiation, will influence the variations which take place in the ionosphere.

The regular variations of the sun, those which are more or less predictable and can be anticipated, can be divided into the following categories:

1. Diurnal
2. Seasonal
3. Geographical
4. Cyclical

Diurnal Variation

The diurnal variation, or the hour-to-hour changes in the various layers of the ionosphere, is caused by the rotation of the earth about its axis. This rotation not only is responsible for variations in the amount of sunlight reaching the earth, resulting in night and day, but also causes a corresponding variation in the intensity of ultraviolet radiation reaching the ionosphere. During the daylight hours, when ultraviolet radiation is strongest, the ionosphere is strongly ionized; during the hours of darkness very little radiation reaches the ionosphere from the sun, and the region decreases to a single, relatively weak layer.

As we have already indicated, diurnal variations in the *D*, *E* and F_1 layers of the ionosphere follow a regular pattern, and are principally dependent on the sun's elevation. Ionization in these layers increases from a very low level at sunrise, reaches a maximum at noon, and then decreases towards sunset. For all practical purposes, these layers disappear at night.

Typical hour-to-hour changes in the critical frequency for the various layers are shown in fig. 5. From this figure it can be seen that only the F_2 layer is not dependent entirely on the sun's position in the sky.

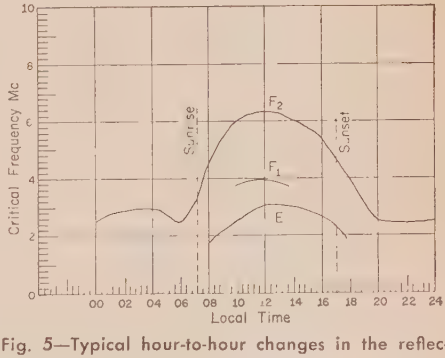

Fig. 5—Typical hour-to-hour changes in the reflection capability of the ionospheric layers.

Ionization in the F_2 region, as shown by the increase in critical frequency, rises steeply at sunrise. Unlike the other layers, maximum ionization is reached a few hours *after* the sun has reached its zenith, or highest point in the sky. Ionization then decreases, reaching low values during the nighttime hours.

The F_2 layer is the most highly ionized of

the regular layers, with considerably higher frequencies capable of being reflected from it. In addition, because of slow recombination rates, it remains in existence throughout the nighttime hours. For these reasons, the F_2 layer is of greater importance to long-distance shortwave radio communications than the other layers of the ionosphere. Almost all DX openings take place by reflection from the F_2 layer.

Seasonal Variation

Since the position of any point on earth is constantly changing as the earth moves in its year-long orbit around the sun so, too, do ionospheric properties change.

Ionization in the E layer behaves regularly, being dependent almost entirely on the sun's elevation. Ionization is much stronger in the summer, since the sun is higher in the sky.

During all but the winter months the F_1 layer critical frequency varies in much the same manner as the E layer, being dependent on the sun's elevation. During the winter, however, the F_1 layer usually merges with the F_2 layer, and cannot be separately identified, except in equatorial regions.

The seasonal behavior of the F_2 layer is rather complicated. During the winter months the sun is three million miles closer to the earth than during the summer. As a result, daytime ionization is very intense, and critical frequencies are high. During the long hours of winter darkness, on the other hand, the ionosphere has more time to lose its electrical charge, and nighttime critical frequencies dip to very low values.

In the summer, a heating effect takes place in the F_2 layer, which expands during the daylight hours, resulting in a much lower ionization density than during the winter. As a result, summer daytime F_2 layer critical frequencies *are lower* than winter values. On the other hand, because of the longer hours of summer daylight, recombination does not occur to the extent that it does in the winter. As a result, F_2 layer nighttime critical frequencies during the summer months are significantly *higher* than during the winter months. The difference between day and night critical frequencies is much smaller in the summer than during the winter.

The complex seasonal behavior of the F_2 layer's critical frequency is shown in fig. 6.

Geographical Variation

The intensity of ionizing radiation that strikes the ionosphere varies with latitude, being considerably greater in equatorial regions, where the sun is more directly overhead, than in the northern latitudes.

Critical frequencies for the E and F_1 regions vary almost directly with the sun's elevation, being highest in equatorial regions and decreasing proportionately north and south of these latitudes.

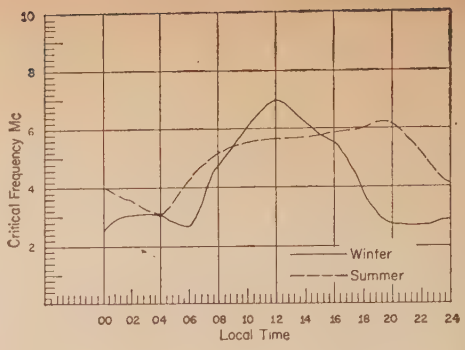

Fig. 6—Typical seasonal variation in the F_2 layer of the ionosphere.

F_2 layer variations with latitude are again more complex. This is probably due to ionization from other sources, such as X-rays, cosmic rays and meteors. There is also evidence that the earth's magnetic field exerts a considerable influence on the degree of ionization in the F_2 layer.

Although complex, the F_2 layer critical frequency does follow a general pattern of being higher in equatorial regions and lower in the higher latitudes and polar regions. In fig. 7 the latitude variation in the F_2 layer is shown by comparing critical frequency measurements made at three locations of different latitude.

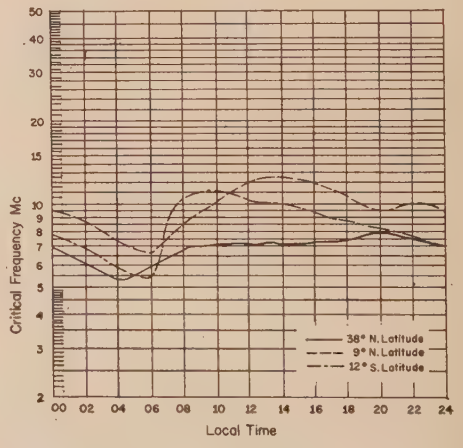

Fig. 7—Latitude variation in F_2 layer critical frequencies. Comparison of measurements made at three locations of different latitude but along the same meridian of longitude; which in this case was 77 degrees west longitude. Measurements were made at the same local standard time during June, 1958.

Although not as complex as the latitude variation, F_2 layer ionization also differs along meridians of *longitude* (at the same local time and along the same parallel of latitude). Much of this variation is believed to be due to the

influence of the earth's magnetic field. F_2 layer ctitical frequencies are generally *higher* in the Asiatic region and Australasia than in Europe, Africa or the Western Hemisphere.

Cyclical Variation

If diurnal and seasonal variations were the only influences affecting ionospheric behavior, the long-range pattern of critical frequencies would be simple and straightforward to establish, with seasonal values expected to repeat from year to year at the same geographical location.

Unfortunately this is not the case. There is also a cyclical variation, of approximately 11 year duration, which is perhaps the most influential factor affecting the ionosphere. This variation depends on the level of sunspot activity, which is constantly changing throughout an approximate 11-year cycle. The solar cycle influence will be touched upon only lightly at this point since sunspots, what they are and how they influence the ionosphere and shortwave propagation, will be discussed at greater length in Part II of this report.

Figure 8 shows the variation in the F_2 and E layer critical frequencies during periods of

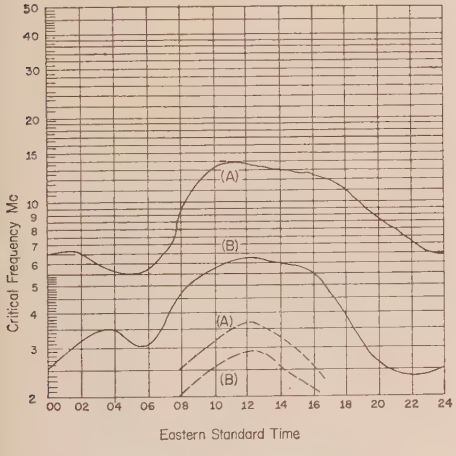

Fig. 8—Comparison of diurnal variation in E and F_2 layer critical frequencies measured at Washington, D. C. Curves A were measured during December 1957 when a sunspot number of 1957 200 was recorded. Curve B was formed during December 1954 when the sunspot number was 12.

maximum and minimum sunspot activity. Figure 9 gives a detailed comparison of sunspot activity and the F_2 layer critical frequency over a twenty-five year period. It can be seen from these figures that the sunspot cycle exerts considerable influence on the level of ionization in the earth's upper atmosphere.

The greatest change throughout the entire solar cycle takes place in the F_2 layer, with noontime critical frequencies approximately *twice* as high during the maximum of the two most recent cycles than for corresponding seasons during the minimum periods of both cycles. The variation during the nighttime hours was not as great, with the midnight critical fre-

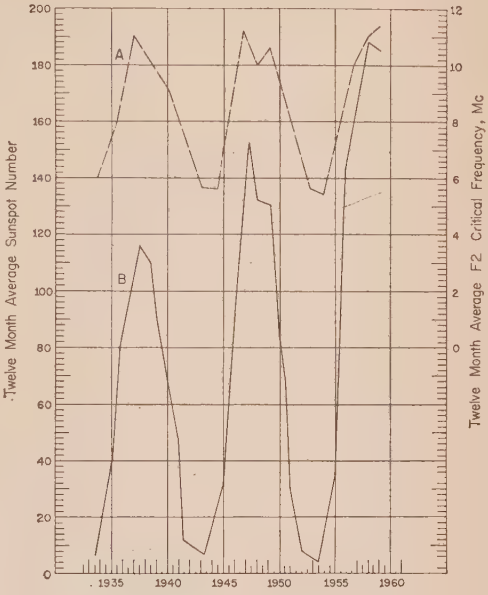

Fig. 9—Variation in the yearly average noon F_2 critical frequencies at Washington, D. C. At A with yearly average sunspot number; at B over a period of two-and-a-half solar cycles.

quency being 1.3 times greater during the peak of the cycle than at sunspot minimum.

The critical frequencies of both the E and F_1 layers also show a close, linear correlation with sunspot numbers, although the variations between the extremes of the cycle are not as pronounced as in the F_2 region.

Up to this point we have discussed the electrical characteristics of the ionosphere in terms of the *critical frequency*. This is the *highest* frequency for which an echo is received when a pulse of radio energy is sent *vertically* upwards into the ionosphere. Later in this report we will show that frequencies used for communication between any two points (oblique propagation as compared to vertical pulse transmission) bear a direct relationship to the critical frequency.

This is the first of a three part report dealing with the impact of declining solar activity on amateur radio during the next several years. In this month's discussion the formation and structure of the ionosphere were described, and its diurnal, seasonal, geographical and cyclical variations explained.

Next month we will continue our discussion with a closer study of sunspots and the sunspot cycle, and their influence on shortwave radio propagation. ■

RTTY With the KWM-2

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Space L-11
Biloxi, Mississippi

Needless to say, RTTY enthusiasts who are also owners of the KWM-2 will find the results of K5YTO's treatment of the subject well rewarding.

AFTER recently obtaining a Model 15 teleprinter, I very abruptly discovered that there is a little more to getting on the air with the KWM-2 on RTTY than just plugging the machine into the wall socket. It was also discovered, (several postage stamps later) that no one had any information concerning F-1 operation of the KWM-2.

I decided that any acceptable modification would have to meet certain requirements: 1) Not impair s.s.b. or c.w. operation. 2) Cause no difficulty in switching from f.s.k. to s.s.b. or c.w. 3) Not reduce the resale value of the KWM-2. The one large problem was divided into two smaller problems; reception and transmission.

Reception

Due to the fixed narrow bandwidth of the receiver, 300 to 2400 c.p.s., a standard audio converter could not be used. A W4TJU terminal unit[1] was built with the discriminator filters changed to *mark* and *space* frequencies of 1275 and 2125 c.p.s. (3rd and 5th harmonics of the 425 c.p.s. standard tone). Audio from the KWM-2 is taken from the 500 ohm output jack, J_9, via an RCA phono plug. This circuit is as easy to build and as reliable in operation as J. D. Wells says it is.

Transmission

Modification of any of the oscillators in the KWM-2 would impair s.s.b. and c.w. operation and would probably reduce the resale value. A plug-in FSK oscillator replacing the h.f. crystal oscillator would not reduce the resale value, but it would have to cover a wide range of frequencies and would also have to be removed whenever s.s.b. or c.w. operation was desired. The solution was found in the KWM-2 instruction manual. To generate a carrier for c.w. and tune up, Collins utilizes a low distortion audio phase-shift oscillator. This audio signal, as it travels down the schematic, causes a double sideband signal to be generated. One sideband is then removed and the signal at the antenna is a single r.f. frequency 1350 cycles from the suppressed carrier frequency. By using two oscillator frequencies, 850 cycles apart, two r.f. signals with an 850 cycle separation will be generated. (See fig. 1.)

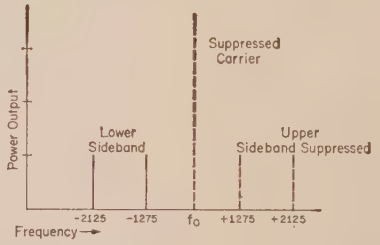


Fig. 1—Sideband output for s.s.b. Tone Modulation

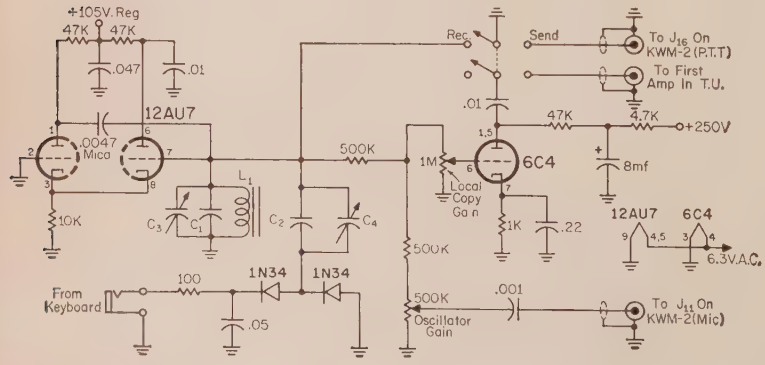
A.F.S.K. Oscillator

An a.f.s.k. oscillator was constructed as in fig. 2, using 1275 and 2125 c.p.s. as *mark* and

[*Continued on page 124*]

[1] Wells, J.D., W4TJU. "Teletype Without Tears", *CQ*, December, 1958, p. 36.

Fig. 2—Circuit of an a.f.s.k. oscillator and an isolation amplifier used to combine the KWM-2 with a Model 15 teleprinter for RTTY.



C_1—7000 mmf mica
C_2—12000 mmf mica
C_3—8-50 mmf ceramic trimmer, Centralab 822-AN
C_4—4.5-25 mmf ceramic trimmer, Centralab 822-CN
L_1—800 mh toroid, UTC N-1492

A Unique Transistor Squelch

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Squelch systems find many applications in C.D., mobile and point-to-point work. Described here is a unique and effective system, not quite the simplest, but requiring only a handful of parts to construct.

It is frequently desired to cut off background noise in a receiver when no signal is being received. To accomplish this, a squelch system is necessary. Most squelches require one or more tubes plus a relay, but presented here is a new transistor application; a simple squelch system requiring but a handfull of small parts.

Circuit Operation

The transistor squelch circuit, shown in fig. 1, is basically a shunt triggered switch. Therefore, when transistor Q_1 is conducting, any audio signal input is switched to ground.

Operation relies on the basic fact that an NPN transistor biased in the forward direction (base *positive* with respect to the emitter) will conduct from the emitter to collector. When the NPN is back biased (base *negative* with respect to the emitter) little or no current will flow between emitter and collector. Thus when the base is biased negatively the collector to emitter impedance is very high. With this information in hand, let us look at fig. 1.

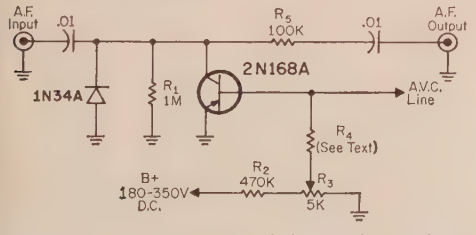

Fig. 1—Schematic diagram of the simple transistor squelch. The device may be either built into its associated receiver or in a small cabinet as an accessory.

As shown in fig. 1, a small positive voltage is applied to the base of Q_1 with Resistors R_2 and R_3 acting as a voltage divider. The adjustable positive bias is applied to the base of Q_1 through resistor R_4, causing Q_1 to conduct from emitter to collector, shorting the audio input line to ground. Well, this gives us nothing but a room full of quiet!

Looking at the receiver, we see that the a.v.c. voltage developed by an incoming signal is negative with respect to ground. The stronger the signal, the more negative the voltage. This negative a.v.c. voltage is also applied to the base of Q_1 and when the incoming signal is strong enough to produce an a.v.c. voltage higher than the positive base bias, Q_1 will stop conducting allowing audio to pass. Potentiometer R_3, varies the positive bias on Q_1, therefore controlling the sensitivity of the device.

Construction

Resistor R_4 acts to isolate and prevent the loading of the receiver a.v.c. line and its value must be determined experimentally, varying anywhere from 22K to several megohms.

Practically any audio NPN type transistor may be used in the transistor squelch, some suitable types being: 2N166, 2N170, 2N228, 2N214 or 2N168A. It may be necessary to juggle some resistor values with various transistors but no component values are very critical.

Application

The transistor squelch will operate quite well with most amateur receivers and can be used for f.m. as well as a.m. In f.m. receivers, the squelch is wired in the same manner but the negative control voltage must be taken from a different point such as the limiter grid circuit. However, a fairly large isolating resistor. R_4, must be used in order to prevent serious loading. In operation, R_3 should be set just high enough to allow the desired signal to trigger Q_1 reliably. No noticeable attenuation of audio gain should result due to the high impedance load presented by Q_1 when biased negatively. ■

Announcing Armed Forces Day

May 20, 1961

THE Army, Navy, and Air Force invite all U.S. and overseas radio amateurs to participate in the Twelfth Armed Forces Day amateur radio program on Saturday, 20 May 1961. Co-sponsored by the Assistant Chief of Naval Operations (Communications)/Director, Naval Communications and the Military Affiliate Radio System (representing the Army Signal Corps and Air Force Directorate of Telecommunications) this program has become a traditional part of amateur radio activities.

Each of the three services will offer a special QSL card. This is a unique card because it is issued only once and this is in connection with the Armed Forces Day amateur communications program. Amateurs who participated in the past have found these cards to be colorful, rare additions to their QSL collections.

A second noteworthy award is the certificate presented for perfect copy of the c.w. code receiving message and the certificate for perfect copy of the RTTY message. Specially signed by the Secretary of Defense, these certificates are considered to be collector's items. The program features:

1.—A c.w. receiving contest open to any shortwave listener who can copy International Morse Code at 25 words per minute. A message from the Secretary of Defense will be sent.

2.—An RTTY transmission sent by Headquarters MARS and Navy radio stations. A message from the Secretary of Defense will be transmitted at 60 words per minute. This contest is open to any amateur operator or other individual who has the equipment capable of receiving RTTY transmissions.

3.—A military-to-amateur transmitting and receiving test conducted for all holders of valid U.S. amateur radio station licenses. Headquarters radio stations of the Army, Navy, and Air Force will operate on spot frequencies outside the amateur bands and establish radio contact with amateur stations.

Awards

Each participant who submits a perfect copy of the c.w. message will be awarded a Department of Defense certificate of merit signed by the Secretary of Defense.

A Department of Defense certificate of merit signed by the Secretary of Defense will be awarded each participant who submits a perfect copy of the RTTY message.

A special one-time Armed Forces QSL card will acknowledge radio contact with amateur stations. Each service headquarters will acknowledge separately so amateurs will have an opportunity to qualify for three different QSL cards.

Operating Schedules

Each transmission for the c.w. and RTTY receiving contests will commence at the indicated times with a ten minute CQ call to permit the participants to adjust their equipment. The ten minute CQ will be immediately followed by the message from SECDEF. It is not necessary to copy more than one station and no extra credit will be given for so doing.

Transcriptions should be submitted "as received". No attempt should be made to correct possible transmission errors. Time, frequency, and call sign of the station copied should be indicated as well as the name, call sign (if any), and address of the individual submitting the copy.

Competition entries should be submitted to the Armed Forces Day Contest, Room BE1000, the Pentagon, Washington, D.C. and postmarked not later than 31 May 1961.

C.W. Receiving Contest

Time 20 May 1961	*Transmitting Station*	*Frequencies, kc*
210300Z ... (2200 EST)	WAR/AIR (Army & Air Force radio, Wash, D.C.	3347, 14405, 20994
210300Z .... (2200 EST)	NSS (Navy Radio, Wash, D.C.)	3319, 4010, 6970, 14480
210300Z .... (1900 PST)	A6USA (Army Radio, San Francisco, Calif.)	6997.5
	NPG (Navy Radio, San Francisco, Calif.)	3319, 7595, 14927.5
	NPD (Navy Radio, Seattle, Wash.)	7455
	AG6AIR (Hamilton AFB, Calif.)	7832.5

RTTY Receiving Contest

Time 20 May 1961	*Transmitting Station*	*Frequencies kc*
210335Z .... (2235 EST)	WAR (Wash., D.C.)	3347, 14405, 20994
	NSS (Wash., D.C.)	3319, 7375, 14480
	AIR (Wash., D.C.)	7915
210335Z .... (2135 CST)	A5USA (Ft. Sam Houston, Texas)	5395
	NDS (Great Lakes Ill.)	7455
	AG5FFR (Randolph AFB, Texas)	7305
210335Z .... (1935 PST)	AG6AIR (Hamilton AFB, Calif.)	7832.5
	A6USA (Army Radio San Francisco, Calif.)	6997.5
210345Z .... (2145 CST)	NDF (New Orleans La.)	7380
	NDW (San Francisco, Calif.)	3319, 7375
	NPD (Seattle, Wash.)	7455

Military-to-Amateur Test

Military stations WAR, AIR, and NSS will be on the air from 201500Z (1000 EST) to 210500Z (2400 EST) on 20 May 1961 to contact and test with amateur radio stations. Amateur contacts will be discontinued from 210245Z to 210400Z to allow the Armed Forces Day c.w. and RTTY broadcast competition in accordance with the schedule above.

Station	Military Frequencies Kc	Amateur Band Mc
WAR (Army Radio, ... Wash., D.C.)	4020 (a.m.)	3.8 to 4
	4025 (c.w.)	3.5 to 3.8
	6997.5 (c.w.)	7 to 7.2
	20994 (c.w.)	21.1 to 21.25
NSS (Navy Radio ..... Wash., D.C.)	4010 (c.w.)	3.5 to 3.8
	6970 (c.w.)	7 to 7.2
	13680 (c.w.)	14 to 14.2
	14480 (c.w.)	14 to 14.2
	*4012.5 (a.m.)	3.8 to 4
		7.2 to 7.3
	14385 (s.s.b.)	14.2 to 14.35
	3319 RTTY	3.5 to 3.8
	7375 RTTY	7 to 7.2
	†20050 (See note)	
AIR (Air Force ..... Radio, Wash., D.C.)	3347 (c.w.)	3.5 to 3.8
	7635 (a.m.)	7.2 to 7.3
	14405 (s.s.b.)	14.2 to 14.35
	15715 (c.w.)	14 to 14.2

*Operator transmitting on 4012.5 (a.m.) will listen in the a.m. s.s.b., sections of the 40 and 75 meter bands for a.m. or s.s.b. stations.

†NSS will key 20050 kc simultaneously with one of the RTTY frequencies listed above. This frequency will be used as frequency propagation conditions dictate.

Military stations will listen for calls from amateurs within the appropriate amateur bands. Contacts will consist of a brief exchange of location and signal report. This is a test of military-to-amateur communications and *no* traffic handling or message exchange will be permitted. ■

Improving Ranger C. W. Operation

Floyd G. Gribben, VE2XR
113 Tulip Avenue
Dorval, Quebec, Canada

Update your early Ranger by installing this new feature that has been factory added to late models.

For those fellows who, like myself, added the equence Keyer to their Mark I Viking Rangrs, I would like to provide the following modiications and improvements to the original intallation instructions.

Before Keyer Kit Was Installed

If the "CRYSTAL-VFO" switch has been in use s shown on page 19, section 2-B of the Ranger Operating Manual," you were able to leave the witch in the "CW" position and zero the v.f.o. ithout the other stages being operative. This is rue previous to the installation of the "Sequence Keyer Assembly."

After Keyer Kit Was Installed

The wiring changes involved in the installaion did not retain the above "spotting" conenience, as all above switch settings require the f. stages to become operative. In order to zero" the v.f.o. with the final amplifier inoperaive, it is necessary to turn the OPERATE switch ack to the STANDBY position each time a freuency change is made. In order to retain the dvantage outlined in the first paragraph, the ollowing changes should be made in the keyer nstallation instructions:

. Cancel step 26 on page 5. This keeps the cutff bias on V_3 & V_4 (6CL6's) when the Crystal-VFO" switch is in the "Zero" position; nus, no drive is supplied to the final amplifier hich is clamped by the 6AQ5.

. Cut the Orange lead (see step 23 page 5) in alf and connect each new end to clip #10 of W_2. This will allow the v.f.o. to run independntly with the "CRYSTAL-VFO" switch in the "Zero" position (with the other stages cut-off) The plate, (pin 1) of the keyer tube (12AU7) i grounded, thus cutting off the blocking bias t the v.f.o. grid and the grid leak R_1 is returne to normal ground.

3. Add the following to step 25. If, before in stalling the keyer, you have been using SW connected as shown in 2-B, page 19 of the op erating manual, then this step, (25) can b omitted as it covers the same arrangement.

4. Previous instruction sheets ended with ste 27 on pag 5, however a more recent issue ha added step 28 as:

"Remove the two black wires from clip #7 of SW_5. Connect these leads to terminal 3 o TS-20. Connect a jumper from clip 7 to clip 3 on SW_5."

This should be corrected to read:

Delete "on terminal 3" and insert "to either one of two vacant terminals." TS-20 should reac X-20. Note: Terminal 3 is already occupied by connections in the audio feedback loop between the driver and the modulator stages.

5. Add to step 28: This step is supplementary t step 17, page 5. The changes in this step (28) grounds one side of the meter to correspond t the grounded meter shunt (SH-1) in step 17, and corrects the unwanted grounding of the key lin when switching the meter to "OSC".

On the back page of the Keyer instructions the diagram shows, at the bottom of SH-1, an arrow and "to SW_4A". This is a drawing erro only. It should have been shown connected t the right-hand end of L_{14}.

By observing the above changes, it will be possible to improve the installation procedure and facilitate flexibility in c.w. operation. ■

The Ultimate Conversion of the Super Pro Receiver

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If you have an old Super-Pro or one of the many surplus versions of this "old faithful", up to $100 to invest (depending on the stock in your junk-box), some spare evenings and week ends, a small kitchen table near a supply of hot coffee or cold bottles, you'll end up with a receiver to match the most expensive modern commercial jobs. These modifications could be applied to the HQ-120, HQ-129X and similar communication receivers

This article has been prepared and dedicated to the many amateurs in the United States and other countries throughout the world who still own and use, or have access to, that grand old behemoth of receivers, the Super Pro. Even though it is many years old, this receiver has all of the basic prerequisites of a modern receiver. The battleship construction lends itself admirably to rigidity and stability and the major components are of a superb quality found only in the most expensive present day receivers. The desire of most radio amateurs to design, create and to strive constantly to improve their equipment has contributed to most of the present day advancements in h.f., v.h.f. and u.h.f. communication developments. My desire to do something constructive was brought about not only by the two articles by L. E. Geisler,[1] and Comdr. Paul H. Lee,[2] but also due to the theft of a newly completed Mohawk RX 1 receiver from my (locked) automobile one very rainy night. However through the offices of a very good friend, I was able to obtain a BC-779 in mint condition.

In planning for a major modification of this receiver, hours of drawing and redrawing sketches, and rereading the previous articles on this unit, were required. I had already completed an earlier modification on one Pro receiver patterned after the two articles, combining the best features of each, plus some ideas of my own. Armed with the experience gained and many new ideas, I was ready to begin planning for the final modification.

[1]Geisler, L. E., "Souping The Super-Pro", *CQ*, Dec., 1957, p. 30
[2]Lee, Cmdr. P., "Save Your Super-Pro For SSB", *CQ*, Sept., 1958, p. 52

In the following modification it should be pointed out that the changes are equally applicable to the other models of the Super Pro, such as BC-779, BC-1004, R-129/U, SP-200, SP-210, SP-400 and others of this series. And with a bit of planning and ingenuity these changes can be used with slight variations for the modernization of the HQ-120, HQ-129X and other similar superheterodyne receivers. It is therefore suggested that the following changes be accomplished one at a time in the order given.

1—The construction of a new audio system and squelch system plus a self contained power supply using the new silicon power diodes, all contributing to the conservation of space, a tremendous reduction of radiated heat and a long trouble free life.

2—An improved product detector and beat frequency oscillator which is voltage regulated.

3—The rebuilding of the entire r.f. section, incorporation of a new cascode 1st r.f. amplifier, grounded grid 2nd r.f. amplifier and twin triode tubes in the mixer and oscillator stages, with voltage regulation.

4—An antenna trimmer capacitor, i.f. gain control and crystal calibrator switch installation.

5—Infinite impedance second detector, audio and noise limiter stages.

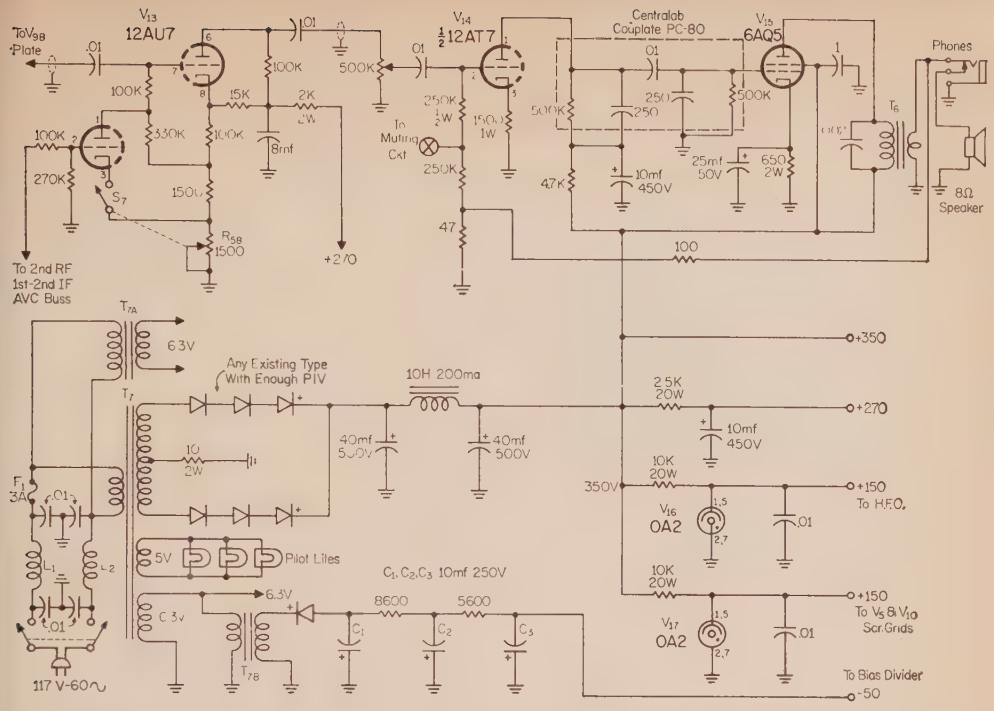
6—A 100 kilocycle crystal calibrator.

7—A "T" notch filter.

8—A crystal controlled converter for the series of receivers which do not cover the 10 and 15 meter bands.

9—Other minor items include the installation of an antenna coaxial chassis connection, auxiliary a.c. outlet and fuse holder.

The manner in which the modifications are



T_6—Universal Output transformer 8,500 ohms to 8 ohms, 5W

T_7—Power transformer—See text

T_{7a}—117v to 6.3 v.a.c. @ 6 amperes—See text

T_{7b}—117v to 6.3 v.a.c.—See text

L_1-L_2—20t, #18E, ¼ diam. close wound.

Fig. 1—Power supply, audio amplifier and squelch circuit. Regulated outputs are provided for the h.f.o. and i.f. screen grids. The 10 ohm resistor in the hv winding center tap is for surge limiting.

made will naturally be left to the discretion of the owner. However, the steps listed here facilitate those steps deemed most desirable. For example, the completion of the power and bias supply, and the audio system and associated circuitry in order to have an operating receiver before beginning other modifications. Precautions must be taken in the wiring of the new r.f., oscillator and mixer stages. Careful orientation of the new 9 pin miniature tube sockets at the time of their installation is important. The other stages were rewired in accordance with good wiring procedures; leads rigid, short and as direct as possible. Use a wiring harness for the major portion of those leads carrying the miscellaneous d.c. voltages. All power leads, as well as all audio leads, were run in shielded wire. The new filament transformer, located in the center rear, was covered with a heavy copper hysteresis shield to prevent 60 cycle hum from being introduced into the antenna circuit.

Suggestions

It is recommended that the newcomer or the inexperienced amateur proceed slowly.

Study each circuit and modification before going ahead.

Do only one modification at a time and tag leads which will be used later. This method will save you many hours of trouble shooting to find mistakes that are inevitable, should you attempt to make all the changes at once.

In order to fully understand all that is to take place, it is highly recommended that the original schematic diagram be on hand and it should be checked frequently. The two previously mentioned articles should be read and their contents thoroughly digested. All of these recommendations will be used with some modifications in order to improve our receiver, and it is extremely necessary that they be followed and completely understood.

When completed, the receiver is self contained, including the new, miniature power supply. It has all of the modifications deemed necessary for present day band conditions. It will do an admirable job of receiving a.m., c.w. and s.s.b. in the crowded amateur bands and can be surpassed only by receivers costing many times more than the cost of this modification.

Power Supply and Sub Chassis Construction

The first step is without a doubt the most difficult, in as much as the new audio system *and* power supply components have to fit into the same space the audio system alone had previously occupied. The new circuit is shown in fig. 1.

To accomplish our first major objective we begin by removing the entire audio system, in-

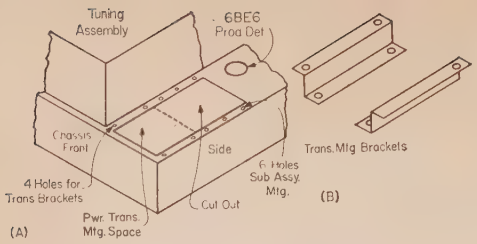


Fig. 2A—Location of new power transformer and audio sub-chassis. (B)—Transformer mounting brackets. Dimensions are determined by the transformer used as explained in the text.

cluding the two audio transformers. Unsolder all leads and remove all components connected to the 6F6 sockets as well as those to the 6C5 socket. Lift the terminal strips fastened to the chassis and tie them up out of the way. Remember; study the original schematic as well as the new one, and if you aren't certain which wires can be removed from the harness, trace out the original schematic and tag those which will remain. Before you start removing the two transformers and the 4 tube sockets, carefully remove the tuning shaft from the b.f.o. transformer, T_5, and lay it aside. Then remove the transformers and sockets, etc. Now that we have plenty of room under our chassis, remove the old volume control and associated wiring and also the ON-OFF, SEND-RECEIVE switch SW_3. In place of the C.W.-PHONE switch we will install our new miniature 3 pole 2 position rotary switch. This is necessary for switching the outputs of our a.m. and s.s.b. detectors to our common audio input. Also install the new 500K volume control with its d.p.s.t. on-off switch. This is easy now, but would be quite difficult later, as the power transformer will be in the way and will complicate wiring. Now is also a good time to install the shielded leads on both of the switches and the volume control. Make them plenty long and tie them back out of the way, temporarily. You can cut them to proper length later.

The next step is to cut out a portion of the chassis in order to install our power transformer, and new sub chassis. Mark the top of the chassis ¼" from the edge, on all four sides, (up to the b.f.o. transformer) and cut out. (Refer to fig. 2 and the appropriate photos.) This can be done by using a 1" square chassis punch on each of the corners, a small hack saw, and a lot of elbow grease. After removing the cut-out portion, smooth and round off all four edges with a small file and emery cloth. The mounting of the transformer is next and how it is done will depend upon which transformer you have selected. It must be sunk below the chassis just enough to clear the tuning shaft of the beat frequency oscillator by ¼ inch and yet no deeper than absolutely necessary, because we must mount our filter choke, capacitors, power diodes and output transformer directly beneath the power transformer. The brackets for mounting our transformer, (see fig. 2), were made of #18 gauge sheet aluminum. Dimensions will again depend upon make and type of transformer used.

Selecting a Power Transformer

The power transformer used in the conversion was a surplus unit that fortunately contained the necessary 100 volt bias winding. Since there is no way of identifying it, a standard commercial transformer must be used. Suitable units are made by Merrit, Stancor and Triad but none have the required bias winding. This is provided for by connecting a 117 to 6.3 volt filament transformer (T_{7_b} in fig. 1) to the 6.3 volt line and stepping it up to 117 volts. The current rating may be very small, 1 ampere or less.

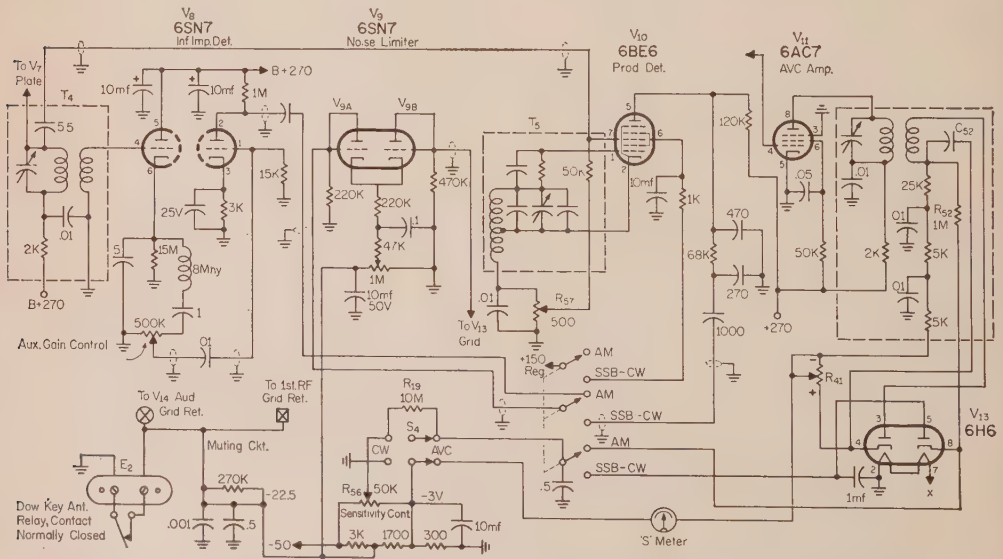


Fig. 3—Modified diagram of the infinite impedance 2nd detector, 1st audio amplifier, noise limiter, product detector, A.M.—S.S.B.—C.W. switch and a.v.c. circuit.

The filament windings on the replacements are not adequate and must be supplemented by a separate filament transformer (T_{7a}) with a rating of 6 amperes. This is the transformer shown in the rear of the underside view of the chassis. It has been wrapped in copper to help reduce the possible 60 cycle radiation into the antenna circuit.

Now select a sheet of aluminum large enough to cover the remaining hole in the chassis. This will be the sub chassis containing six miniature sockets, three 9 pin and three 7 pin miniatures. These are for the two audio stages, squelch stage, 2 voltage regulator tubes (0A2) and 1 spare 9 pin miniature for possible future use. Drill the necessary holes for mounting all of the sockets and tie point terminals and wire up all of the audio, squelch and the voltage regulator stages before securing the sub chassis to the regular chassis. Allow plenty of lead length for connecting of grounds, filament and B plus voltages, as they can be cut to the desired length later. The sub chassis is then secured to the main chassis by six #6 quarter-inch long self-tapping sheet metal screws.

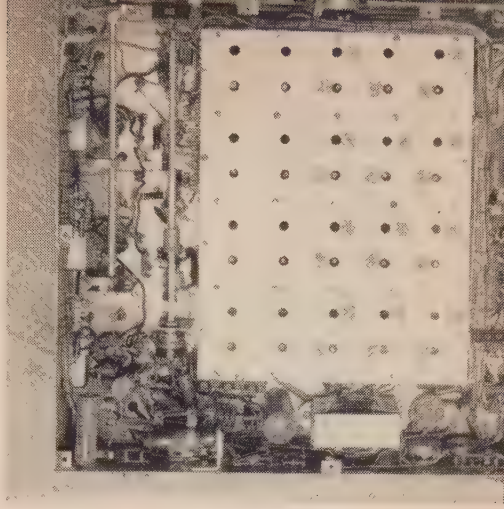
We can now mount our filter choke on the inside edge of our main chassis. The dual section 40 mf filter capacitor can also be mounted securely to the side of the chassis. The power diodes are mounted on a small piece of micalex or other good insulating material, and the whole assembly is mounted on stand-off bushings on the side of the chassis. Wire up the rectifiers, power transformer and filter circuit and install the line filters and fuse holder. Now wire in the new power on-off switch and the power supply may be tested. Voltage will be quite high without a load, so I suggest a 15K 20 watt resistor be connected across the output filter during the voltage measurements.

We are now ready to complete the wiring of the audio section. Finish wiring the two 0A2 voltage regulators. The 10K 20 watt resistors can be mounted conveniently above the back of the main chassis. The squelch circuit can also be wired at this time, if desired.

The squelch control potentiometer and its on-off switch are now mounted in place of the old SEND-RECEIVE SWITCH. Here, again, to avoid any possible chance of hum pick up, all audio leads are run in shielded wire. You are now ready to check out the receiver with the new audio system and the new power supply. If you haven't goofed somewhere it should take off and operate as before.

Product Detector

The next step is to install the product detector and modify T_5. Remove the 6SJ7 b.f.o. tube and its octal socket. Unsolder the leads from the socket as they aren't long enough to begin with. Substitution of a 7 pin miniature tube socket in place of the octal socket is accomplished by using either a small square sheet of aluminum or one of the Mallory metal mounting wafers used for



The bottom view shows the location of the auxiliary filament transformer in the rear center of the chassis. To the left are the 2 ten watt resistors used in conjunction with 0A2 regulators and to the extreme right is the line filter mounted on standoffs. On the right hand lip of the chassis is the output transformer and towards the front, the filter choke.

their can type electrolytic capacitors. They come in three sizes and are very well suited for adapting small sockets to large holes formerly occupied by octal sockets. The MP-4 will accommodate both 7 and 9 pin miniature tube sockets by merely using a ½" or ¾" socket punch to enlarge the existing hole. The socket can be soldered directly to the wafer *after* it has been correctly oriented for minimum lead length. This not only applies to the product detector tube, but to all other stages, particularly the new front end of the receiver. In most cases the original mounting holes in the chassis can be re-used if you position correctly before soldering.

The shield can on T_5 can now be removed in order to gain access to C_{49}, the original plate voltage blocking capacitor, and to remove it entirely from the circuit in order to provide a d.c. return for the cathode of the 6BE6 product detector. However, this connection does not go directly to ground. Remove this lead from its lug on the terminal board of the transformer and add a new lead about 12" long. This lead will connect to the top of R_{57} 500 ohm pot which we can now mount conveniently on a clear space on the rear lip of the chassis. Re-assemble the transformer, taking care not to allow any internal shorts to exist. Refer to the schematic of V_{10} in fig. 3 and wire this stage.

R.F. and Oscillator Section

The r.f. section of the receiver has been modernized to accommodate modern miniature tubes. The high frequency oscillator and its cathode follower (V_3 in fig. 4) are fed from the voltage regulated 150 volt line of V_{16}.

A 3 mmf negative temperature coefficient capacitor is placed across the oscillator tank cir-

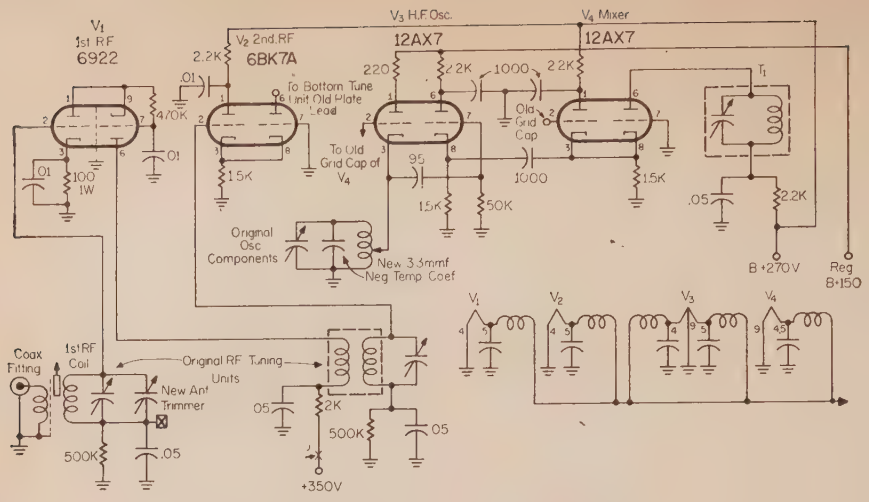


Fig. 4—Modified diagram of the 1st and 2nd r.f. amplifier, high frequency oscillator and mixer circuit. Chokes in the filament circuits improve the operation on the high end and stability is improved by voltage regulating the oscillator and use of a temperature compensated capacitor in the oscillator tank circuit.

cuit but is not done until the next step when the tuning unit cover has to be removed.

The second r.f. amplifier uses a 6BK7 and remains a grounded grid stage. The first r.f. stage, however, has been changed to a cascode amplifier which supplies increased gain with considerably less noise. This circuit follows the S-9er circuit[3]. Amperex has developed a new tube, the 6922 dual triode especially for this type of circuit and it works exceptionally well in ours. This tube must be operated in accordance with the manufacturer's specifications in order to achieve maximum gain and uniform operation. It is rated at 1½ watts plate dissipation, and the voltage on each plate and the maximum current should be followed closely. Maximum current can be checked by breaking the plate voltage lead to this stage at point "X" in fig. 4, the schematic of the modified r.f. section, and inserting a 0 to 50 milliameter. The reading should not exceed 23 milliamperes. If the current is too high or too low the 2K resistor in the plate voltage line must be changed until a satisfactory reading is obtained. The oscillator and mixer stages are now completed. The original 95 mmf capacitor coupling the oscillator to the mixer is used again in our modification, so use care in removing and resoldering it. Keep the heat away from the capacitor by allowing the long nose pliers to dissipate it.

The filament chokes and bypass capacitors are installed. The chokes are made of #18 enamel covered wire, close wound on a 3/16" diameter form, 20 turns per coil. These help somewhat in increasing the high frequency performance of the receiver at the high frequency end of the dial. Realignment of the new r.f. section will be necessary and will be covered later.

[3]Kyle, J., "More On The S-9er, Mark II", *CQ*, Dec., 1959, p. 38

Antenna Trimmer, IF Gain, Crystal Calibrate Switch

The installation of the antenna trimmer is next on the agenda and we begin by removing the front panel. Remove all dials and pointer knobs, screws and brackets holding the panel. Carefully remove the S meter. While the panel is off, drill new holes for the antenna trimmer shaft bushing and the 100 *kc* crystal calibrator switch, SW_6. Also remove the old on-off power switch and its wiring, and in its place install a new 5000 ohm pot. This is our new i.f. gain control. Connect three long color coded wires to the terminals before installing and wire them later as shown in fig. 6.

Center the hole for the antenna trimmer above the main tuning dial escutcheon plate, midway from the top of the panel. Center punch and drill a 3/8" diameter hole. The hole for the 100 kc crystal calibrate switch, SW_6 can be located and drilled at this time. It should clear the dials and the front edge of the chassis by at least ¼". Drill a 3/8" diameter hole approximately 1⅛" above the center line of the hole formerly occupied by the old A.C. ON-OFF switch. Solder two lengths of hookup wire to the switch before mounting. Leads should be approximately 24" long after twisting together. They can then be extended up behind the panel along the top left edge of the tuning unit. They are held in place along the edge of the tuning unit by small plastic cable clamps secured by the four cover plate mounting screws and small washers.

We next remove the top cover plate on the left side of the tuning unit. Install the 3 mmf zero temperature coefficient capacitor across the main oscillator tuning capacitor as shown in fig. 4. Now solder a short piece of hookup wire to the stator connection of the large tuning capacitor of the 1st r.f. stage. Replace the cover tempo-

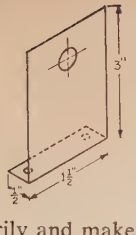


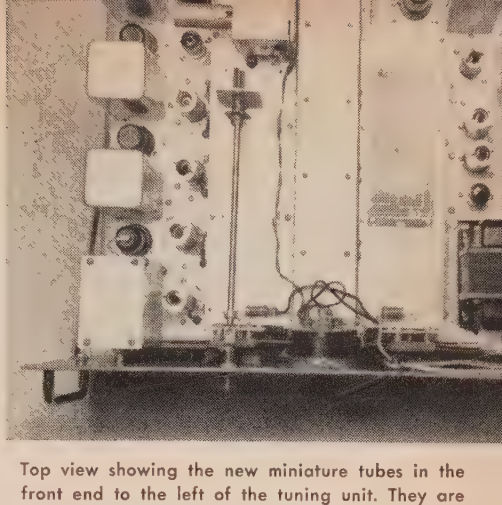
Fig. 5—Mounting bracket for the antenna trimmer.

rarily and make a pencil mark directly over the connection. Drill a ¼" hole and insert a small rubber grommet. Make a right angle bracket as shown in fig. 5. Use a piece of scrap aluminum, 3" x 1½" x ½". Drill two holes for mounting, using a number 31 drill. Drill one ⅜" hole for mounting the variable 35mmf antenna tuning capacitor. Mount the bracket on the cover, using ¼" 4-40 machine screws, nuts and lock washers. Make sure the top surface of the tuning unit has been scraped clean of the coating of moisture fungus proofing. Now mount the variable on the bracket and replace cover and all of the screws removed. You can now replace the front panel after everything has been assembled. Install a flexible coupling between the antenna trimmer and the ¼" brass tuning shaft. Install the panel bushing and the second short piece of ¼" brass shaft. Connect the two brass rods with a ¼" universal coupling. A second coupling may be used as a stop and mounted directly behind the panel. Install the knob and you have an antenna tuning capacitor. The 1st r.f. coils must be modified to accommodate this new capacitor but we will leave this to be done in a later step.

Infinite Impedance 2nd Detector, Audio and Noise Limiter

Our next operation is the rewiring of the old 6H6 diode 2nd detector and noise limiter circuit to an infinite impedance detector and first audio. Remove the late i.f. transformer (T_4) from the chassis and take off the shield can. Remove all of the components on the mounting board except the small 5.5 mmf capacitor, the variable capacitor and the i.f. coil. Connect as indicated in fig. 3. You will now have five leads coming from the i.f. unit. If the original leads are too short this is a good time to install longer ones. Replace the 6H6 detector with a 6SN7 or 12AU7, and wire as shown. One triode section is our new infinite impedance 2nd detector, and the other half the new first audio amplifier. Install the auxiliary volume control in the rear of the chassis along side, or near to, the 500 ohm pot. At the same time remove the meter zeroing pot, R_{41}, and install it on the rear lip near the other two. These controls, once set, need not be touched again.

We also use a 6SN7 or 12AU7 in the noise limiter in place of the 6N7. Wire the socket as shown in fig. 3. This *must* be done prior to installing the 1 megohm variable threshold pot and the on-off switch. Next, remove the old ANL switch and shaft. Replace it with the 1 meg pot. Install a ¼" shaft coupling on the arm of the pot. Cut off enough of the old shaft so that the pointer knob will clear the panel by ⅛".



Top view showing the new miniature tubes in the front end to the left of the tuning unit. They are from front to back, 12AX7, h.f. oscillator, 12AX7 mixer, 6BK7 2nd r.f., 6922 1st r.f., 12AU7 a.n.l. To the rear of the 12AU7 is the old 6H6, V_8. The 6H6 is replaced by a 12AU7 or 6SN7 and is the new a.m. detector and first audio. This modification was not yet made when the photos were taken. The power transformer may be seen at the lower right mounted low enough to clear the b.f.o. shaft. Behind the power transformer is the audio sub-chassis with the left row of tubes (from front to rear) being, 12AU7 audio, 12AX7 squelch and spare socket. The right row is 6AQ5 output, 0A2 and 0A2. To the rear of the sub-chassis is the new product detector V_{10}, 6BE6. The new antenna trimmer may be seen mounted on the left side of the tuning unit. To the rear of the capacitor is the crystal calibrator.

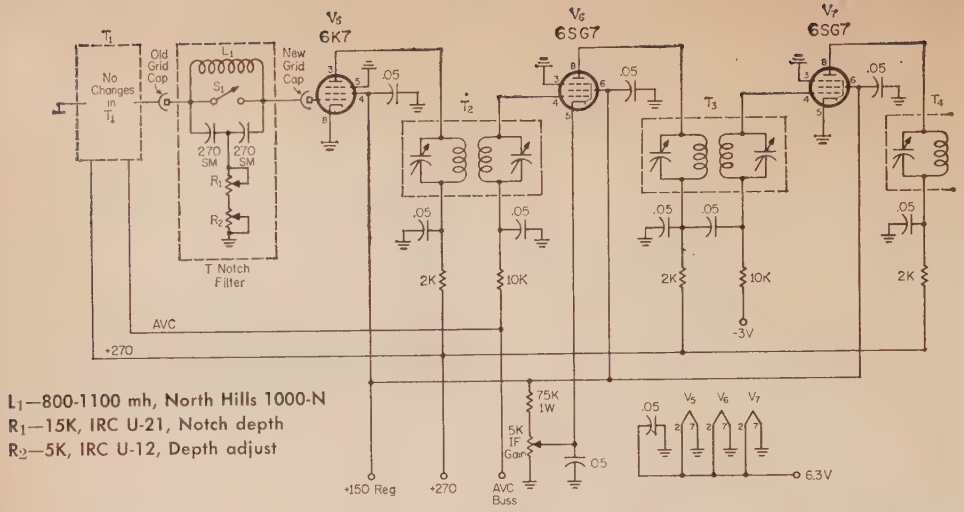
We now have a new noise limiter which really works, plus a new infinite impedance 2nd detector. This circuit will have to be realigned, and after completion it will be found that the i.f. selectivity has been improved considerably because the detector does not load the secondary winding of the last i.f. transformer, T_4. We no longer need a diode detector; it is a mystery why one was ever used.

We use a diode, V_{12}, to provide our a.v.c. voltage. Make sure the a.v.c. switch is rewired correctly. Replace R_{19}, (a 1 or 2 megohm resistor) with a 10 megohm resistor. Check and make sure your bias voltages are correct, *i.e.*, —3 volts and —50 volts. Be sure and ground the unused contact on the AVC ON-OFF switch.

A 6AC7 is substituted for V_{11}, a 6SK7, providing additional gain in the a.v.c. amplifier stage. No other modifications are made at this socket.

100 KC Crystal Calibrator

You can next assemble, build or buy, one of the many crystal calibrator units now sold by several manufacturers. It can be placed conveniently close to the antenna trimmer capacitor by mounting the unit on a small sheet of aluminum slightly longer than the calibrator base. The aluminum bracket is drilled so that the holes



L_1—800-1100 mh, North Hills 1000-N
R_1—15K, IRC U-21, Notch depth
R_2—5K, IRC U-12, Depth adjust

Fig. 6—There are no changes in the i.f. section other than the addition of the new 5K i.f. gain control. The "T Notch" filter shown between T_1 and V_5 is optional and may be installed if desired. Increased gain may be had by substituting 6SG7's for the 6SK7's V_6 and V_7.

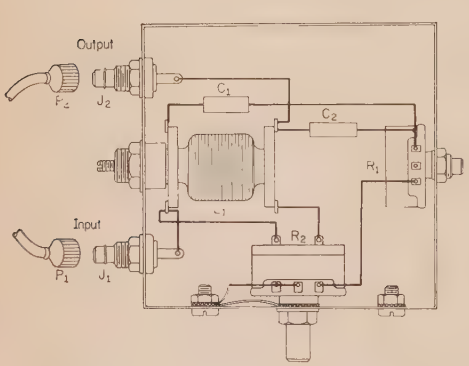


Fig. 7—Pictorial of the "T Notch" filter layout and wiring.

match those of the two holes on the left rear of the r.f. tuning unit. The two 4-40 binder head screws should hold the unit securely in place. A small socket is installed in the hole formerly used by the tuning meter pot. The hole may be enlarged to accommodate the miniature socket, if necessary. The one used in our case was an Amphenol miniature hexagon, series 126, 4 pin, cat. no. 28J740. It requires a ¾" diameter hole. Connect B plus, B— and 6.3 v.a.c. to the socket. B plus 150 to 250 volts is wired through the CALIBRATOR ON-OFF SWITCH SW_6. A small three conductor cable made of hookup wire and a matching 4 connector plug is connected to the calibrator unit. This switch now applies B plus to the calibrator unit. The calibrator output wire is capacity coupled to the antenna trimmer by wrapping 2 turns around the lead coming through the grommet.

"T" Notch Filter

The "T" notch filter was installed after the photographs were taken, however, it is presented for those who desire to build and install one in their receiver. The entire unit is assembled in a small aluminum midget chassis, 2⅝" x 2¾" x 1¼" and mounted directly behind the panel, centered midway between the top of T_1 and the top of the panel. The circuit is shown in fig. 6 and layout in fig. 7. It is held in place by the 5000 ohm notch depth pot and two 8-32 machine screws. All of the components will mount inside of the chassis. The s.p.s.t. switch is also mounted on the notch depth pot. The variable inductance is a North Hills 1000-N. The capacitors are 270 mmf silver mica type. The small Switchcraft phono plug and jacks were used for connecting the unit in the circuit. The coil can be peaked with a signal generator once the set is functioning.

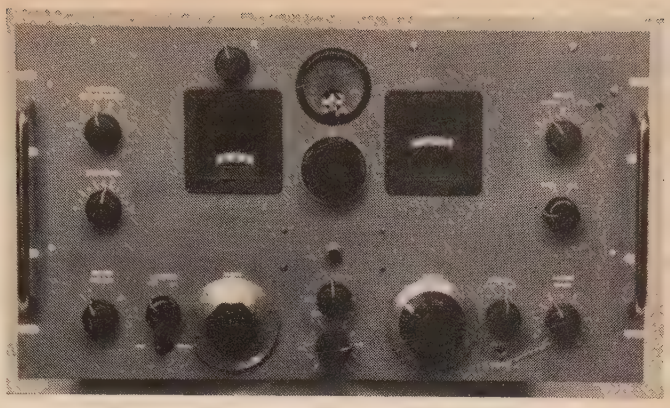
Converter Stage

After all of the modifications were completed and the set was realigned and checked out, it was our desire to increase the frequency range of the receiver so that we could also enjoy the 10 and 15 meter bands. The h.f. converter was patterned, circuit wise, after the "Bonus 10-15 meter Converter," described in *QST*[4]. It was built with slight modifications, such as an r.f. gain control in the cathode of the r.f. amplifier, and an antenna transfer switch for switching the unit in or out of the antenna circuit when not in use.

RF and IF Alignment

The i.f. transformer T_4 will require realignment because of the modifications to the 2nd detector stage. The secondary is not loaded nearly as much as before. The alignment can be accomplished quite easily, by using a signal generator tuned to the center of our i.f. frequency, 465 kc, or by tuning in a strong, steady carrier such as a local broadcast station and adjusting

[4]McCoy, L. G., "The 'Bonus' 21-Mc. Converter", *QST*, Oct., 1958, p. 33



The front view shows few changes. The control functions to the left of the main tuning dial are unchanged. Above the tuning dial is the antenna trimmer. Below the bandswitch is the 100 kc calibrator switch, the new i.f. gain control and the sensitivity control. The switch to the right of the bandspread knob is now the A.M.-S.S.B. made selector while above the audio gain knob is the new squelch control. The notch filter, added after this photo was taken is located above the crystal selectivity switch.

the tuning capacitor for maximum reading on the S-meter. An attempt to realign the entire i.f. section is not advisable unless you have the instruction book, access to a f.m. or TV alignment generator and oscilloscope. However, if you are a purist and must try, follow the procedure as outlined by L. E. Geisler, in the December 1957 issue of *CQ*, on page 32.

1st RF Stage Coil Modification

After the set has been checked over and given its smoke test, all the mistakes and omissions corrected, and signals are pounding in very well, you are ready to proceed with the alignment of the r.f. section of the receiver. All that is necessary is a signal generator which can be tuned to 2.5 *mc*. Turn on the signal generator or frequency meter and let it warm up for several hours. This also applies to the receiver. While this is going on, there is still work to be done. Turn the receiver over on its left side, (uggghh). Remove the bottom plate from the r.f. coil housing assembly. Now locate the three h.f. 1st r.f. coils. They are along the rear wall. Remove the 6-32 machine screws holding the antenna coils. Pull the antenna coil away. The Faraday screen will also come away with the antenna coil exposing the 1st r.f. grid coil. Do one modification at a time. Starting with the 2.5 *mc*. coil, unsolder the wire which runs from the top of the coil, the end facing you. Pull the loose end through the two holes in the coil form. Remove three turns of wire from the coil and push the wire back through the two holes, pull tight, clean the enamel from the end of the wire and resolder. Apply some coil dope to the coil and reassemble the tuning unit. Proceed to the 5-10 mc r.f. coil assembly. Repeat the procedure, only this time remove only two turns. Then proceed to the 10-20 mc coil; this time remove only one turn but do not cut it off. Excess wire is now formed on the inside of the coil form in the shape of a circular loop as large as the inside diameter of the coil form. Poke the end of the remaining length of wire through one of the holes and resolder the wire to the original connection. You now have a circular turn of wire, which can be rotated, inside of this coil form. By rotating the turn of wire, you will be able to tune the 1st r.f. stage to resonance when the antenna trimmer capacitor is set at mid range. Cement the coil in place and reassemble the r.f. unit. You will now have an antenna trimmer capacitor which will really peak each signal right on the nose. The capacitor will peak at mid range on all three bands.

If you have checked the performance of the receiver before making this modification, try it again and you will be amazed at the overall improvement. Before making this change, a signal from the signal generator was used as a reference signal. The generator frequency was set to the center of each of the three amateur bands, e.g., 75 meters: Set the receiver band switch to the 2.5 mc-5 mc band. Adjust the output frequency of the generator to 3.8 mc. Tune in the signal on the receiver and adjust the generator output or coupling so that the receiver signal as indicated by the S Meter reads S5. The modifications were then made, and after completing, the receiver was again tuned to the generator frequency. An increase of 3 to 4 S units was noted on all three bands. This has been the average improvement on all of the conversions which have been made. It certainly is a worthwhile improvement, well worth the short time required to make it.

RF and Oscillator Alignment

In order to complete the alignment of the oscillator and the r.f. stages, it is suggested that the procedure outlined by L. E. Geisler be followed without deviation. Also it is imperative that the signal generator output frequency of 2.5 *mc* be rechecked against WWV each time, before proceeding to the next high band. We might add, that in our case, both the receiver and signal generator were left on overnight, before starting the calibration of the r.f. stages. If this procedure is followed, the receiver calibration will be as accurate as it is humanly possible to read the calibration of the dials. NOTE. It is especially important to set the newly installed antenna trimmer capacitor to its mid position before the final alignment of the first r.f. stages. Make sure all of the tube shields are in place.

S Meter Circuit

The completed modifications on the a.v.c. detector V_{12} changes the circuit slightly, and now

R_{41} acts as a sensitivity control across the meter. If a signal generator with a calibrated output is available, the meter adjustment can be set to correspond to the calibrations of the meter. Or if a suitable generator is not available, one may use a strong signal, such as a broadcast station or short wave station, to calibrate the meter; e.g., adjust the pot R_{41} until the meter just pins on an extremely strong signal. The meter will read 0 with no signal in.

T_5 Tuning

After modifying the b.f.o. transformer T_5, it will be necessary to retune the transformer to the i.f. frequency. The modification on the coil connection changes the frequency slightly. It will be necessary to center the b.f.o. tuning capacitor and make sure the pointer is also in mid position. With an insulated screw driver adjust the variable padder capacitor C_{48} to exact zero beat with an incoming signal. Once this adjustment has been made it will be possible to receive c.w. and s.s.b. signals. All that remains for s.s.b. reception at its best is the proper setting of R_{57}. Tune in a good strong s.s.b. signal, free of interference, and slowly rotate the arm of R_{57} until the received signal reaches maximum volume and minimum distortion at the same setting or time.

Muting Circuit

The muting ciruit is extremely simple and quite adequate, utilizing the —22.5 volts for bias on the 1st r.f. stage and the 2nd audio amplifier stages. The applied increase in bias cuts off the plate current of the 1st r.f. amplifier, and 2nd audio stages. The relay terminals E_2 were used and rewired for proper connection to our coaxial antenna Dow relay.

The complete modification took many evenings, and lots of hours of work, plus a couple of long week ends at the home of W2CLG. Most of the work was accomplished, however, on a small kitchen table in a Brooklyn apartment. Therefore, anyone having a good work bench, plus the normal amount of hand tools and necessary equipment, will find the project much easier. The entire cost of the receiver modification, including the h.f. converter, was just under $100.00 and all can be accomplished for considerably less if there is a good supply of parts already on hand. Only the best of components were used. All disc type capacitors were the 600 volt rating. Other capacitors, such as filter capacitors and the large bypass capacitors, were either the molded type, or metal can type, with the highest possible working voltage. Multi-section filter capacitors were used wherever possible to conserve space.

This modification has been one of the most interesting, constructive and challenging projects undertaken, and once completed, you too will have a receiver which will stack up alongside the best of them. It is now a pleasure to operate on c.w.-a.m. or s.s.b. and the stability is excellent. Too, with the addition of the h.f. converter, we are now able to cover the high frequency bands. The addition of a crystal controlled converter further adds to the stability of the h.f. bands. The signal to noise level has been greatly improved. On the 75 meter phone band, on a Sunday afternoon, we can now copy an S-1 signal Q-5. In addition to covering all the h.f. Amateur bands, we can also cover all of the commercial frequencies as well as the MARS frequencies. We hope you will enjoy your newly rejuvenated receiver for many years.

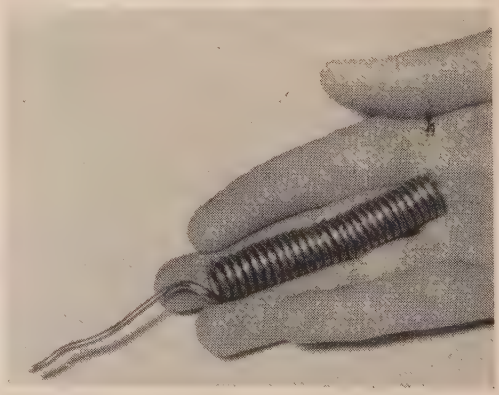
While you are working on your receiver, perhaps other improvements and modifications will come to mind. The front panel appearance has been changed very little. The main difference is the addition of the new controls. A new band set dial and band spread dial were added. These were the 2½" Crowe instrument dials calibrated 0-100 in 360°. They add to the appearance and help calibration. Duplicate pointer knobs were available on the surplus market.

Credits

I would like to offer profound thanks to all those who have helped with suggestions and encouragement. Special thanks to Mr. Carol Freed for his very kind and able assistance and advice in the use of the 6922 Amperex tube used in the 1st r.f. stage, and suggestions which helped us in our simplified muting circuit. A special kind of thanks to Lew for his splendid critical comments, encouragement and suggestions, and for the use of the many pieces of test equipment and bench facilities required in the final completion, alignment and testing of the completed receiver (and also for the many cold bottles of nourishment during the day, and the hot coffee during the late hours).

To those of you I may have tempted, I offer you the best of luck. Many long hours of good listening and good hunting. May all of you make DXCC. See you all from Greenland! ■

Ham Hints



Easy To Use Soldering "Coil"

Solder is much handier to use when you wrap it into a spring-like coil as shown. You can use it like a "pencil" and pull out more solder as needed. Form the coil by wrapping the solder around a wooden dowel, pencil, or other round object.

Automatic Antenna Switching

Ronald L. Ives
2075 Harvard St.
Palo Alto, Calif.

A simple and effective relay system to insure that the antenna is connected to the operating receiver and if no receivers are operating the antenna is grounded.

Back in the "good old days" of radio, when vacuum tubes had an extra filament lead coming out the side, it was customary to disconnect the antenna from the receiver, and to ground the antenna whenever the receiver was not in use. This laudable practice has now been abandoned at most installations, a majority of operators depending on either a lightning arrester or luck to protect the equipment from atmospherics; and upon some special angel to prevent antenna coil burnouts from strong local pickups.

The advantages of an antenna grounding switch can now be obtained automatically by use of a small relay in place of the massive copper and slate Murdoch switch which formerly graced one wall of the radio shack. Simplest circuits, involving one receiver and one antenna, comprise fig. 1. In these circuits, when the relay is energized, the antenna is connected to the receiver; when the relay is not energized, the antenna is grounded, and the antenna terminal of the receiver is also grounded.

Where several receivers normally operate from one antenna, the control circuitry becomes slightly more complicated, but grounding of the antenna when no receiver is in operation, and connecting any and all receivers in the system to the antenna at will, is still possible, as in fig. 2. In this circuit, when the relay corresponding to any receiver is actuated, that receiver is connected to the antenna, and the antenna is removed from the ground line. More than one receiver can be connected to the antenna at one time, if desired.

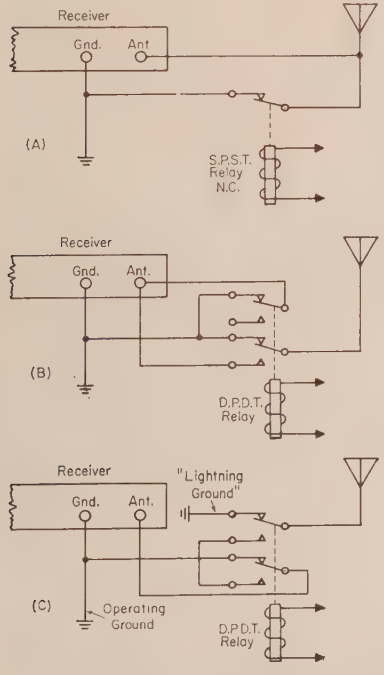


Fig. 1—Three simple antenna grounding circuits.

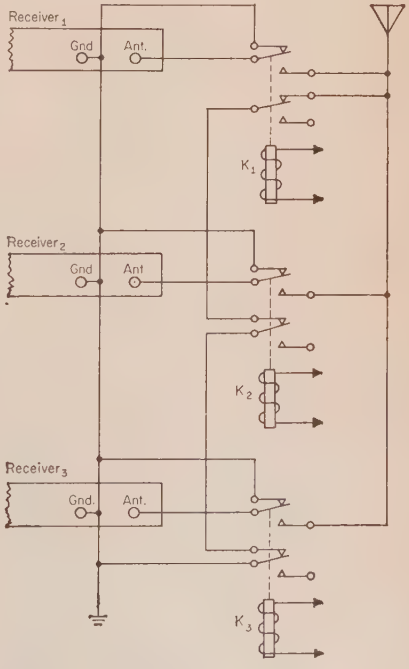


Fig. 2—Antenna switching circuit for use with several receivers. When no relays are energized all the antenna terminals are grounded as well as the antenna.

Dipole and other specially-connected antennas can be automatically grounded by a rather obvious extension of the circuits shown.

Whatever the automatic grounding and connecting system used on an antenna, it is advisable to also use a lightning arrester as called for by either the Underwriters' specifications or the local electrical code. In some instances, your insurance is void if you do not follow the codes. Additionally, in areas subject to frequent electrical storms, dust storms, or blowing snow at low temperatures, a neon static drain, and a d.c. isolating capacitor, are desirable antenna adjuncts. Whereas a standard lightning arrester will not conduct until the antenna system is 5,000 or more volts above ground, a neon static

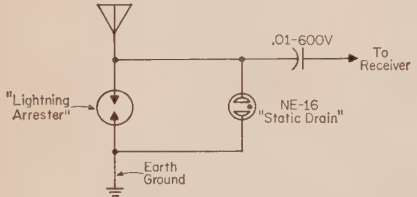


Fig. 3—A recommended antenna protection circuit frequently used in military circuits.

drain will "fire" at about 75 volts. The circuit of this additional protection, which will be familiar to many who have used military communications equipment, is shown in fig. 3.

Current to operate the antenna switching relay is controlled from the receiver, and can usually be obtained from the receiver quite easily. A 115 volt a.c. relay shunted across the receiver power transformer primary functions beautifully, as does a 6.3 volt a.c. relay shunted across the filament circuit. In each case, the relay is actuated whenever the receiver is turned on.

In communications receivers equipped with a "standby" switch, which opens the plate supply in "standby" position, a d.c. relay having a suitable pull-in current rating can be wired in series with the negative return to the transformer. The small voltage drop caused by insertion of the relay resistance can usually be made up by increasing the size of the first filter capacitor. In some receivers, a suitable relay can be connected in place of the last audio stage cathode resistor. With both of these connections, the antenna is disconnected from the receiver, and grounded, whenever the receiver is switched to "standby" position.

With any of these circuits, or of their numerous rather obvious alternatives, the receiver is protected from all sorts of antenna pickup whenever it is turned off; is automatically connected to the antenna when it is turned on, and in multiple receiver setups, only the operating receiver is connected to the antenna system. ■

Edison Award to W6NLZ and KH6UK

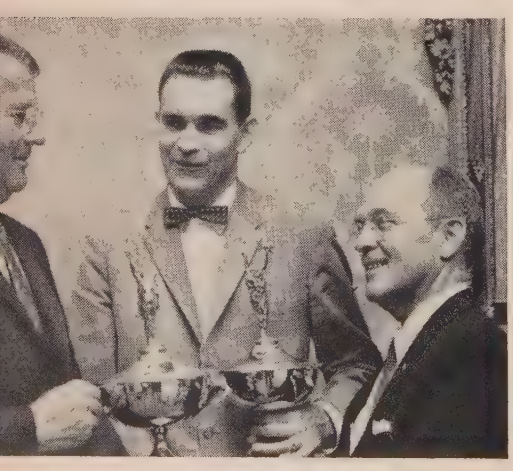
RALPH Thomas KH6UK and John Chambers, W6NLZ were recently awarded the 1960 annual Edison award for their outstanding achievement in v.h.f. communications on 144, 220, and 432 mc. The principal speaker at the dinner held in Washington, D. C. February 23, was Frederick W. Ford, Chairman of the Federal Communications Commission. The following are excerpts from his address.

". . . We have had a businessman and a railroad dispatcher, [as award winners], an electronics teacher and a blind night school teacher, a food broker and a Bible student, an eighteen-year-old boy and, yes, even a housewife. Tonight we add a communications engineer and an electronics expert. This varied group of amateurs proves that amateur radio reaches all strata of the American way of life, a fact which to my mind, is one of the most edifying characteristics of the amateur service.

"Adding a touch of novelty, and most deservedly so, tonight we honor a joint accomplishment with a joint award. For it was the efforts of two amateurs which made the most important amateur radio accomplishment of 1960 possible. Like our original amateur pioneers, Ralph Thomas and John Chambers entered the wilderness of radio wave propagation.

"Much like the early days when the amateur proved that long distance transmission below 200 meters was possible, so have John Chambers and Ralph Thomas established the possibility of communication over a distance of more than 2500 miles entirely within the earth's troposphere on 144, 222 and 432 megacycles. We know that this accomplishment far exceeds any records previously established by other amateurs for this mode of radio wave propagation, and, to our knowledge, it also greatly exceeds any known records established by private laboratories or government-sponsored projects.

"On behalf of the F.C.C., I commend Messrs. Chambers and Thomas for the vision, ingenuity and perseverance which they have applied toward the accomplishment for which we honor them here tonight. It is performance such as this which confirms our belief in the value of the radio amateur to his country and makes our task at the Commission well worth the effort".



L. Berkley Davis left, General Electric vice-president, presents trophies to John Chambers, W6NLZ and Ralph Thomas, KH6UK, joint winners of the 1960 Edison radio amateur award.

Resonance Trouble

Herbert C. Hartman
Lt. Col. USAFR—Ret.
Harvey Cedars, New Jersey

THINGS were nicely simmering down around the QTH at Harvey Cedars, and the XYL was beginning to accept my ham activities as a way life. Slightly eccentric, she said, but after all, there oddballs and beatniks and such, and if I was wing senile, she guessed she'd just have to put up h it.

Then I had to go and do it again!

Many times I have been a bit envious of those thren who have hams for wives, but after care- analysis, I am convinced that the old fashioned e that doesn't know r.f. from the daily double is far the best bet.

Not that there is anything wrong with my wife's .! Far from it! Let's just say that scientific gress has not caught up with her femininity, and it go at that.

Actually, the real instigator of the mess that I got was Ray Morris, W2QYS, of Harrison's who l me the Collins 30 S-1 Linear. He knew how I about that rig from watching me drool over it, every time I dropped into the store in New York, would show me some new feature that he'd just covered'. What a salesman!

'm reluctant to tell you how I actually financed deal, but don't be surprised if you see my QTH nged to the county poor-house.

didn't take me long to realize that 20 amps at volts is a lot of juice, and although I hadn't red on re-wiring the house, that's the way the bounced. (Sometimes I think that one of those nces must have caught me in the head!)

Well, I finally got everything set, and almost got rig tuned up on 20 when the 15 meter trap let go. a split second I really thought that the top sec- of my two band vertical was going into orbit, that eliminated 20 right then and there.

Oh well, 15 is the best band anyway," I thought, eing an expert by now, it only took two days to ist what was left of a four band vertical to 15 usively.

he radials which I had installed were low-slung close to the ground, and I carefully pruned and isted them for the best s.w.r.

owever, to my painful surprise, I found that a of r.f. at the end of those innocent looking booby- s offered no loving caress.

his worried me more than a little, because it bad enough to have my neighbors fall over them n they came for a visit, but if they were 'hot' to t, I was really in for trouble!

o off came the radials.

y combining a ground-mounted antenna with a tuned ground-plane, and the fact that the ground rod was in tide-water, made the s.w.r. meter a very nice tide-gauge. This new arrangement didn't help things a bit, but the rig sure got out. I honestly believe that even a peanut-whistle could raise DX at my QTH, tide and s.w.r. notwithstanding, although no one can deny that a gallon sure packs authority! Even the local cop, who used to be a good friend, now gives my house a dirty look when he drives past with his squelch turned all the way up.

However, as time went on I began to miss some of my friends on 20. Every now and then I would switch bands on the receiver and a deep sense of futility would set in whenever I'd hear a CQ. At those times I felt as though I were on another planet.

The answer was obvious—put up another vertical. But where? No one has ever accused me of being a coward, but after past experience with the XYL, I was taking no chances, and this new location was going to be well thought out.

My grandson provided the answer when he flushed his plastic submarine down the bathroom fixture and I had to open the cess-pool in back of the house and run a snake up into the soil pipe to get the "Nautilus" off a reef.

Now, the QTH is on an island and the elevation is extremely low. You can reach salt water any place by just digging to a depth equivalent to the tide level, and this tide business gives rise to a very uncertain SWR, because of the varying height of the reflecting plane. However, I suddenly realized that over the years, the level in the cess-pool had remained fairly constant. Here was the perfect answer. Drill a hole in the concrete top and drive a length of pipe down through the bottom and mount the 20 meter antenna as a ground-plane affair. Perhaps a bit close to the house, but you can't have everything. I even cooked up a sleeve arrangement for adjusting the ground portion of the pipe. I'll admit it was a little messy getting the coax in, but when did *that* ever stop a ham?

The XYL watched the proceedings with one of those expressions that sort of raises the hair on the back of my neck, but I think she conceded that as long as I *had* to put another one, I had picked the least objectionable location.

This time I had very little trouble getting the antenna to resonate. For once the mathematics worked out in practice, and a little adjusting of the "Rube Goldberg" sleeve did the trick. It was so easy that I was wishing for another cess-pool for a 40 meter set-up.

[*Continued on page 116*]

The Single Tube Product Detector

Commander Paul H. Lee, USNR, W3JHR
5209 Bangor Drive
Kensington, Md.

Don't trade your receiver in just because you think it is not suitable for sideband. Here is a simple modification that will provide a product detector and crystal controlled b.f.o. No outboard chassis or major structural changes are required and while designed for the Collins 51J-2 the circuit is applicable to most other receivers.

THE number of amateurs using single sideband is steadily increasing. More and more are seeing the light and are converting to this power-saving and spectrum-conserving mode of communications. To this I say a hearty "Amen!" The commercial companies and military systems have been using this method for years, and it is about time that the amateur fraternity caught up with progress, especially in view of our increasing numbers and dwindling spectrum space. This article is written to help the newcomer solve his single sideband receiver problem.

It is possible to receive single sideband on an old receiver that is satisfactory for c.w. or a.m., by turning on the b.f.o. and then reducing r.f. gain to the point where the signal is readable. Of course increased audio gain is required. Also, this method results in a considerable loss in sensitivity, since it is no longer possible to run the r.f. stages wide open. This situation is due to the fact that the diode detector is not designed for this mode of operation, and that b.f.o. injection level is insufficient. The i.f. signal must therefore be reduced to a very low level. Also, even though the desired i.f. signal may be sufficiently reduced, a strong undesired signal on an adjacent channel may be rectified, giving rise to interference that will be quite severe.

It is difficult to obtain the full benefits of single sideband reception under such makeshift conditions. A product detector is a necessity if one is really seriously interested in single sideband work. Unfortunately many receivers of recent, modern design do not contain product detectors. But instead of trading in that old receiver, why not make a simple modification to bring it up to date? It is very simple to install a product detector without cutting holes for additional tube sockets, making outboard adapters, or changing receiver circuitry materially. Many product detector circuits use several additional tubes, but the circuit described here requires no additional tubes, not even a socket change.

The station receiver at W3JHR is a Collins 51J-2 which is an excellent set for amateur and general coverage use. The commonly used 75A-series is quite similar to it, but is designed for those who like to be "partially blind," confining their listening to the amateur bands. The inherent long and short-term frequency stability of the Collins p.t.o. used in these sets is excellent. The accuracy of dial calibration and ease of tuning makes these receivers ideally suited for single sideband use. However, the product detector is a very desirable modification, and the conversion is easily done by changing the b.f.o. tube to a 6BE6 product detector. The original b.f.o. circuit of the 51J-2 is shown in fig. 1.

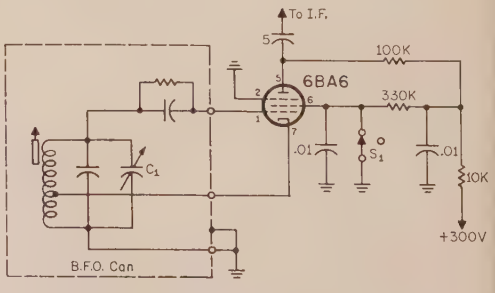


Fig. 1—Original b.f.o. circuit of the Collins 51J-2. A Standard Hartley is used with C_1 acting as the front panel B.F.O. PITCH control and S_1 B.F.O. ON-OFF.

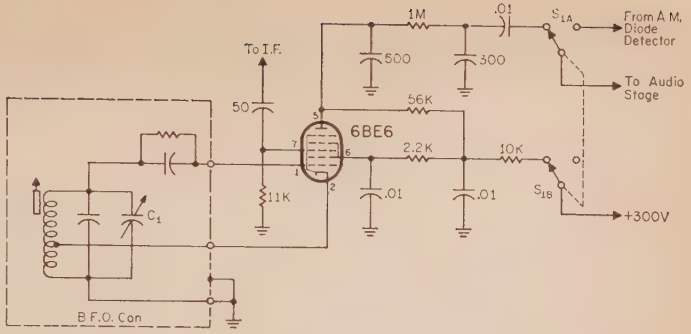


Fig. 2 — A 6BE6 replaces the original 6BA6 and the oscillator section of the tube acts as the b.f.o. The i.f. signal is fed to the mixer grid. Switch S_1, formerly B.F.O. ON-OFF, is now AM-SSB.

Conversion Circuit

The simple conversion to a self-excited product detector is illustrated in fig. 2. The 6BE6 is used in a mixer circuit. Its screen acts as the anode for the oscillator section of the circuit, with the existing b.f.o. coil and capacitor being used as the oscillatory circuit. The i.f. signal is fed into the injection grid. The values of the injection grid bias resistor, and of the screen dropping resistor are adjusted to give distortion-free product detector reception of single sideband signals. This can be checked by killing the oscillation in the 6BE6. This is most easily done by shorting cathode to ground. Without oscillation, there should be no audio output from the product detector while receiving signals of any type.

Conversion

The actual physical changes involved in the receiver are few. The tube substitution of the 6BE6 for the 6BA6 b.f.o. requires no socket change, only rewiring. The b.f.o. can is left alone. The b.f.o. on-off switch on the panel is replaced with one having an extra set of contacts which are used to switch the audio stage from the a.m. detector output to the product detector output, simultaneously with the application of plate voltage to the 6BE6. This switch is S_1 in the circuits. The additional audio wiring to this switch should be done with shielded wire to avoid a.c. or r.f. pickup.

It is also necessary to slow down the a.v.c. action by changing the time constant of the circuit, so that the a.v.c. rides along on the peaks of the single sideband signal. In my 51J-2 this is done by changing the value of R_{144} to 5.0 megohms. The reader will have to check out the a.v.c. circuit of his own receiver and make the necessary adjustments to the time constant R-C circuit. Thus the r.f. gain can be left wide open.

The modifications described above can be applied not only to the Collins series of receivers, but also to other makes as well. The b.f.o. circuitry may vary somewhat, but with a bit of ingenuity the reader can adapt this principle to his own set. Whatever the b.f.o. tube, it would be desirable to make a substitution that would not require a socket change, such as a 6BE6 for a 6BA6, or a 6SA7 for a 6J7 or 6SJ7, etc.

Crystal Controlled B.F.O.

If one wishes to carry the conversion a bit further and obtain a more sophisticated product detector, it may be crystal controlled. I did this to my 51J-2, to remove the only possible source of frequency instability in single sideband reception. Three crystals were used in the circuit shown in fig. 3. These are surplus FT-241-A low frequency crystals, for channels 359, 361, and 360. Their respective frequencies are 498.612, 501.388, and 500.000 kc. The 51J-2 i.f. frequency is 500 kc, and this choice of crystals provides for reception of upper or lower sideband, in addition to providing a crystal right on i.f. frequency for c.w. work or for frequency measurement.

[*Continued on page 118*]

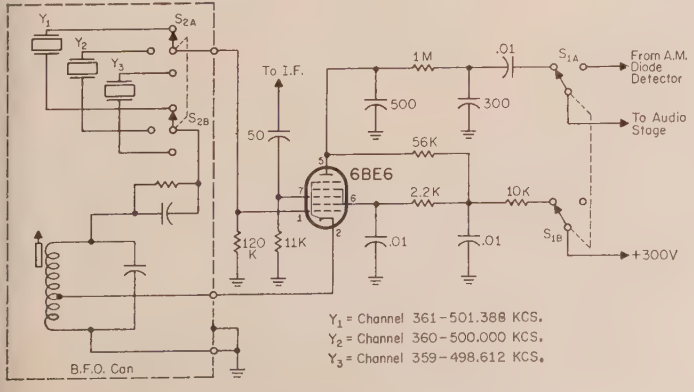


Fig. 3—The same circuit as fig. 2 except that the b.f.o. is crystal controlled. Crystals Y_1 and Y_3 are for the upper and lower sidebands and Y_2 is on the i.f. frequency for c.w. reception. Switch S_2 is mounted where C_1 was formerly located.

Power Supply Regulation

Paul Barton, W6JAT
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San Jose 8, Calif.

A discussion of the basic principles of power supply regulation and some techniques for improving it.

I am often surprised by the number of radio men, not necessarily beginners, who do not know how to get good power supply regulation. It is really quite simple and is covered in all the amateur handbooks. Did I say everyone is a dummy? Well, I didn't mean to be quite so blunt, but—aren't we?

Capacitive Filter

To begin with, a capacitor across the output of a rectifier system with no load (fig.1) will charge up to a d.c. voltage equal to the peak voltage of the a.c. input. This peak value is 41% greater than the reading on the usual, or r.m.s. reading, a.c. voltmeter as shown in fig.2.

As a heavier and heavier load, *R* in fig. 3, is placed across the capacitor, the d.c. output will drop back towards 90% of the a.c. input r.m.s. value.

Thus in a 1000 volt rectifier system with only a capacitor filter, the output voltage will vary from 900 to 1410 volts depending on the load.

Inductive Filter

By putting enough inductance in series with load (fig.4), the voltage can be prevented from "soaring".

The minimum value of choke for this purpose is numerically approximately equal in henries to the number of thousands of ohms in the load. In other words 10,000 ohms for 10 henries in fig.4 will result in holding the d.c. output down to about 90% of the r.m.s. a.c. input. Likewise 100,000 ohm load and 100 henries will prevent the d.c. output voltage from soaring.

In a 2000 volt power supply we could use a 20,000 ohm bleeder and a 20 henry choke for good regulation. This would result in a 1/10 ampere bleeder current or 200 watts. If this is more bleeder current than you can afford then raise the value of the bleeder resistor, and also increase the inductance of the choke. Naturally this higher inductance choke is pretty expensive.

Regulation Demands

"How come?" you say. "I've been using 6 henries and a 50,000 ohm bleeder in my a.m. rig for years and my regulation is OK."

It is the constant load of the a.m. rig that makes the difference. The power supply never sees *on*

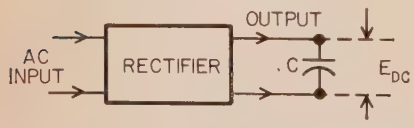


Fig. 1—A capacitor across the rectifier output will charge to the peak of the a.c. input if unloaded.

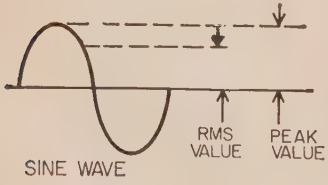


Fig. 2—Relationship between the r.m.s. and peak values of an a.c. voltage.

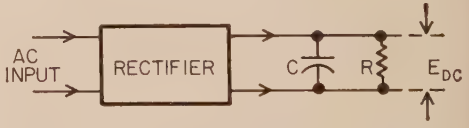


Fig. 3—Power supply output load will cause the output voltage to drop to 90% of the r.m.s. input.

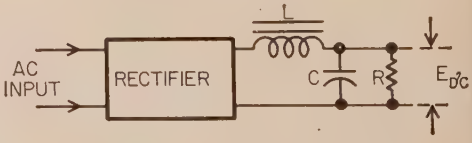


Fig. 4—The addition of a series inductance aids greatly in stabilizing the output voltage.

Zero Bandwidth Modulation

Dr. Shorza Gitchagoome
Sweep Modulation Labs
Los Angeles, California

PHONE signals that occupy zero or near zero bandwidth have long been the dream of scientists and amateurs alike, c.w. requires no bandwidth by virtue of the fact that a carrier has no width. The carrier is just as wide as the receiver makes it. Practical considerations prevent us from realizing a bandwidth of less than 50 to 100 cycles, but even this offers vast savings in spectrum space over phone requirements. Amplitude modulation requires around 6 kilocycles of valuable band space; single sideband requires around 2 kilocycles. Obviously a phone bandwidth of 50 cycles would be a tremendous scientific breakthrough for radio amateurs.

Those of you who have thought in these channels will be delighted to learn that it is not only theoretically possible to reduce the phone bandwidth to a very low figure, it is actually practical and the purpose of this article is to prove just that.

To the best of my knowledge the principle of *sweep modulation* has not appeared in print before though it is certainly an old idea.

Brush up on Theory

When a carrier is modulated, sidebands are created. These sidebands are actually new carriers transmitted at the side of, and in addition to, the main carrier. Although we call this amplitude modulation, the amplitude of the carrier *does not* change with modulation. When we view an amplitude modulated carrier on an oscilloscope, we see variations in the carrier amplitude only because the 'scope is unable to separate the carrier from the sidebands and the picture is actually a composite. It is a result of all three components, the lower sideband, the carrier, and the upper sideband. Single sideband enthusiasts will have no difficulty seeing this point for they know that they have removed the carrier and one set of sidebands, impossible surely if the carrier was actually amplitude modulated.

What the Detector Sees

As far as the detector in a receiver is concerned, it is receiving an amplitude modulated signal. It is quite important that this point be realized. As was the case with the oscilloscope, the detector is not able to separate the sidebands from the carrier and it accepts the components as a whole. The detector is not fussy where the individual bits and pieces come from. One set of sidebands may have come from a transmitter a thousand miles away and the carrier may have been generated in the receiver itself; it matters little. What *is* important is that *the detector receives an amplitude modulated signal.*

Modulation

The carrier may be modulated in many ways. It may be modulated in the plate circuit of the final as is being done in many stations this very minute. It may be modulated in the antenna circuit. Old timers will remember a system known as loop modulation which was based on this principle. We may even modulate at the antenna. Gas filled tubes placed across the mouth of a parabolic reflector, when suitably connected to a modulator system, will modulate the carrier even though no actual physical connection is made to the antenna.

The Sweep Method

Imagine a beam of radio energy being swept back and forth across a certain point. As the beam moves toward point X (Fig. 1) the signal at that point will increase. The signal will reach

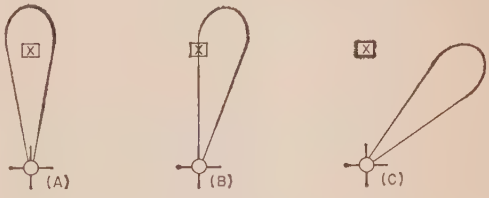


Fig. 1—Antenna movement with respect to signal strength.

a peak as the beam passes over point X and diminish in amplitude as the beam moves away. If now we gear the beam to a 1 kc audio generator so that the beam sweeps back and forth at 1 kc a second, it will give back the original sine wave component in the receiver detector located at point X. This assumes that a steady carrier was transmitted. The *signal* that reaches the detector at point X is *amplitude modulated* at 1 kc per second!

To better visualize what happens when a more complex waveform is used, consider what happens in the groove of a phonograph recording. Here, in spite of the mass of different sounds that are transmitted at any one moment, you will find only one grove, and only one needle on that record. If modern music can be contained in the groove of a phonograph record, it will be obvious that it is in no way difficult to contain the voice of a ham calling CQ in the sweep of a radio

beam. Instead of sweeping back and forth in an even rate, the beam will now move about in a spasmodic manner.

The Receiver

The receiver is the heart of the entire system. Without a special receiver there is no advantage whatever in using sweep modulation, even though sweep modulation may be copied on an ordinary receiver. As mentioned earlier, a carrier has no width. Our sweep modulated transmitter is generating only a carrier. The user is not modulating the carrier in any sense of the word, he is sweeping the beam back and forth in accordance with the modulation. The receiver is receiving a signal that is varying up and down in *amplitude, not in width,* and has no sideband products. Therefore, the receiver should have as small a bandwidth as is practical. The receiver may be reduced right down to zero bandwidth, or as near to that as practical limitations will allow. Remember we have no sidebands, yet the receiver is detecting an amplitude modulated signal exactly as before. The advantage of this system will be immediately recognized. Unfortunately, it is not possible to design a receiver with zero bandwidth and it is necessary to put up with something like a bandwidth of 50 to 100 cycles. However, at 100 cycles we will be able to accommodate 20 stations in the space presently occupied by one s.s.b. station!

Splatter . . . ? ***Impossible!*** Consider again Fig. 1. In (a), the beam is pointed directly at the receiver and the signal strength is maximum. In (b) the beam has moved to the point of minimum reception. In (c) the beam has moved beyond the point of minimum reception. What happens now? This condition is shown in Fig. 2

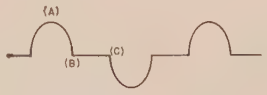


Fig. 2 — Clipping caused by sweeping beyond point of reception.

and will be recognized as negative peak clipping. A not-so-nice name for it is splatter! And splatter it is, that we can't deny. But, and there is a very large but—this splatter is created in the receiver! The point of minimum signal is determined by the receiver antenna system and the receiver itself. Another receiver in the same position might still be receiving a signal even when the beam is at (c). The point of importance is that the splatter is confined to the receiver. In this you are on your own. No longer can you blame the transmitter for causing splatter!

Compensations

Narrow bandwidths stand for better signal-to-noise ratios. Every time you divide the bandwidth by two, you improve the signal by 3 db. Cut it in half again and you have a 6 db improvement over the original. By reducing the bandwidth from 2 kc. to 100 cycles, it is possible to obtain more than 10 db improvement in SNR. The QRM will be largely removed or greatly reduced. And as the receivers are improved so will the QRM situation. Even with two million amateurs, the conditions should be no worse than they are presently.

The Beam Sweeper

Before the reader assumes this to be an "April Fool" article, the author hastens to reassure that such rotating beam systems are obviously not possible, or at least practical. This illustration was used simply to point up the principles of sweep modulation. A practical system of accomplishing this unique modulating system is about to be described.

In order to obtain a substantial power gain it is necessary to condense the power transmitted by the station into as narrow a beam as possible. This very necessity imposes problems that are only partially overcome. Cumbersome arrays are necessary in order to get a narrow beamwidth. To see a 20 meter array rotating back and forth at something like 1,000 cycles per second would truly be a sight to behold! Therefore, the present state of the art forces us to use simple static antennas whose radiated power is caused to sweep in the required manner. The method shown was evolved only after many years of trial and error—mostly error! It is pointed out here that the method has severe drawbacks. However, it was money from government grants, and the old arch enemy time, that dictated how the project should be handled. It is felt that the publication of this article will be the cause of newer and better systems being evolved.

Construction

In Fig. 3 is shown two half-wave dipoles, one at right angles to the other. The dipoles are fixed in their mounts and are connected to the transmitter by feedlines of equal length. The feedlines are then connected to the field coils of a somewhat novel goniometer. As shown in Fig. 3, the two coils are at right angles to each other. Inside the fixed coils is the armature or search coil (a). Coil (a) is able to move in the horizontal plane and is in fact swept through an arc of some 90°.

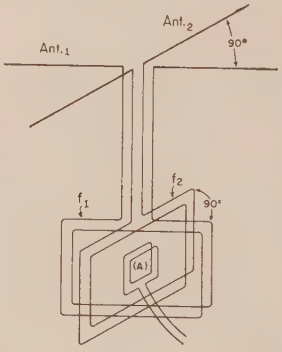


Fig. 3—Schematic of the goniometer and antenna.

Those of you who have been connected with radio aboard ship will immediately feel at home with the goniometer for it was once part and parcel of every shipboard radio cabin. Any similarity between the Bellini-Tosi direction finder

and the author's sweep system is not coincidental! Space will not allow a complete description or mathematical analysis of the system. Interested persons are advised to read Section T/13-14, Admiralty Handbook of Wireless Telegraphy, Volume 1, published by His Majesty's Stationary Office, London, England. No doubt there are very many similar publications available in the United States.

Briefly, when the search coil (a) is in the same plane as F1, coupling is maximum and the radiation from antenna 1 is maximum. Because the search coil (a) is at 90° to the plane of F2, coupling will be minimum and radiation from antenna 2 will be minimum. If now the search coil is moved through an arc of 90°, the opposite state will exist and antenna 2 will radiate while radiation from antenna 1 will be minimum. It will be seen that an intermediate setting of the search coil will result in radiation from both antennas, which due to the phase relationship between the two transmitted signals, will result in maximum radiation in a direction half way between the plane of the two antennas.

Search coil (a) consists of 2 turns of ⅛" aluminum wire with ⅛" spacing between the turns. The turns are rectangular in shape and are 11" high and 3" wide. The coil is fitted to a mechanically stable insulating material such as micalex. At the top and bottom two high grade case-hardened pivots are attached. The coil must be perfectly balanced and with the very minimum of inertia. It has to sweep at very high speeds and must be therefore free to do so. It should be neither damped or given extra inertia. The assembly is pivoted in jewel bearings top and bottom which, in turn, are firmly mounted in lead-filled cups.

A bar magnet 1" long and ¼" X ¼" on a side is now fitted to the inside of the coil. This magnet is mounted immediately over the bottom pivot and at right angles to the plane of the coil. The magnet must be insulated from the coil, but very firmly mounted and *exactly* balanced. The whole coil assembly is now turned on its side and balanced by soldering spots of aluminum solder to the coil.

Next, the two coils F1 and F2, which each consists of 2 turns of ¼" copper tubing (for 300 ohm lines) are wound and mounted in place. Their diameter must be such that the vertical portions of the coil clear the search coil by not more than 1/16".

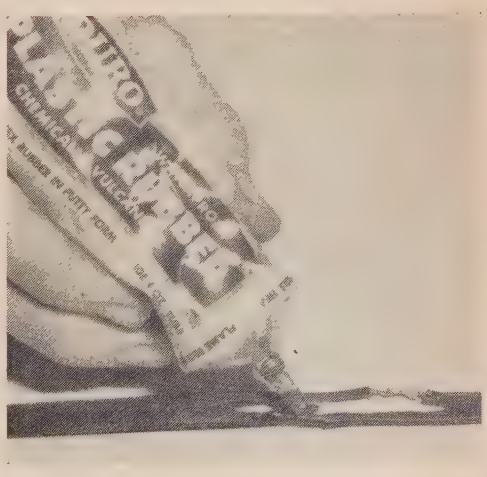
Next, solenoids consisting of two cores (one for each solenoid) of soft iron baling wire is made up into bundles 1⅛" in diameter and each is wound with 15,603 turns of #38 enamelled wire. The two solenoids are mounted opposite the sweep coil but between the coils F1 and F2 in a manner that allows their fields to exert maximum attraction or repulsion upon the magnet in the sweep coil. Naturally they are both mounted free of the arc cut by the sweep coil itself. The two coils are series connected and excited by approximately 10 watts of audio. Since the coils are a high impedance they may be connected between the plates of a suitable push-pull amplifier. If the push-pull tubes are properly balanced there will be no d.c. flowing in the coils. The completed coils should be dipped in insulating varnish. The length of the cores is not critical but should be around 2" to 2½".

When it is determined that the whole system is working properly, it is placed in a brass can, the leads are brought out through insulators and the can is sealed and evacuated. In the original design, a vacuum pump from a farm milking machine was pressed into service. If none is available, you can have this part of the construction commercially done. The purpose, of course, is to remove air which would otherwise slow up the motion of the coils.

In fairness to the reader, it should be pointed out that the coil cannot move through a full 90° arc due to the mass of the coil. However, there is sufficient movement to "modulate" the carrier. Naturally the amount of motion determines the depth of modulation and here is the only weakness of the system. The sweep system should find wide application in the vhf and uhf regions where higher beam gains and easier methods of phasing the antennas can be realized. The components necessary to modulate the beam will also have less mass at higher frequencies.

The author would appreciate hearing from others who have experimented with this system, particularly in regards to more efficient ways of varying the signal applied to the antennas. ■

Ham Hints



Rubber Tape In A Tube

A tube of plastic rubber available at hardware stores, makes ideal "liquid rubber tape" for wire splices. Its insulating qualities are adequate for most practical purposes and it has an additional advantage in that it won't dry out or unravel like tape. A dollar size tube is enough "tape" for hundreds of wire splices.

VHF Exposé

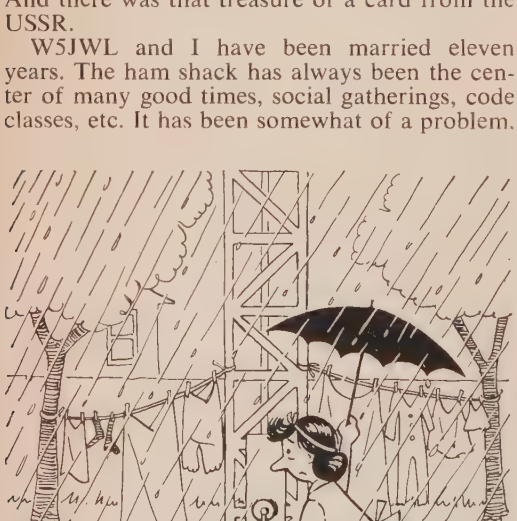
Martha Harwell, XYL of W5JWL
Gurdon, Arkansas

The hilarious tribulations of a v.h.f.-XYL.

There have been many articles about spouses engaged in different phases of ham radio. These I've read with fascination and complete sympathy. I've waited in vain for that one about the trials and tribulations of a v.h.f.-XYL (or OM). Finally deciding the breed is either pretty rare or this type of information has been withheld deliberately, I've decided to tell all. So at the risk of being banned forever from amateur gatherings, here goes.

To review a bit. . . . We have been through the whole routine of 75 meter round-tables where you get to know all the fellows and their families. Ten meter DX hunting was thrilling. Such excitement greeted those QSL cards from distant places like England, Spain and Africa. And there was that treasure of a card from the USSR.

W5JWL and I have been married eleven years. The ham shack has always been the center of many good times, social gatherings, code classes, etc. It has been somewhat of a problem.



Many of our thunder storms occur in the daytime.

as many of you know, to explain to friends families, and neighbors, just *what* about ham radio could cause anyone to prefer it to attending family reunions, club banquets or fish fries. Just about the time these folks begin to realize how interesting it can be to talk all across the country and to foreign countries, and having read in magazines and newspapers of the many good deeds of amateurs, they decide that maybe all that wire strung overhead is worthwhile. . . then, WHAMO!

The v.h.f.-bug bit JWL and has moved in with us. Things have certainly changed! Now the revolution is coming to a lot of you. Here are some things to expect.

Monstrous piles of aluminum tubing will appear. These are for making two meter arrays of all types. All will have to be tried, tested and improved. JWL is in the TV business. Every windstorm adds to our stock piles. XYLs, guard these with your lives. Don't let my terrible experience befall you. An unknowing plumber borrowed a precisely cut element to probe for the sewer line. What a dark day that was!

Next, the prospective v.h.f. ham will become a more avid collector of surplus radio gear. Since most v.h.f. hams build all or a big part of their equipment, an enormous supply of parts is needed. Many useful components can be taken from surplus gear (or so I've been told). A resourceful v.h.f. man never throws away any old equipment, for someday he may find just the nut and bolt he needs to build the new convertor in that old four feet by six feet piece of gear. My hair dryer was recently confiscated for use as a blower.

JWL's long yagi beam takes considerable attention. It's mounted on a telescoping tower. He used to leave it up, supported by a maze of guy wires. It was damaged in a wind storm, so now *we* raise and lower it. He raises it—and since many of our thunder storms occur suddenly in the daytime—I lower it. It's still a little embarrassing to catch the stares of neighbors as I crank madly, while the clean, dry laundry on the clothes-line gets soaking wet. First things first, you know. I need a clothes dryer.

You will soon learn not to plan vacations in August. That's the month of the big Perseid

eteor shower. (You'll learn a lot about astron-
my, too.) v.h.f. enthusiasts take advantage of
eteor showers and the aurora borealis to prop-
gate their signal and work long distances.
Long distances on v.h.f. could mean working
e next state or across several states.)

There are several big showers a year and
any minor ones. You will know when one's
proaching by the enormous increase in mail
. post cards mostly asking for schedule dates
d times. Also, there will be increasing num-
rs of long distance phone calls during the
ower. I think some of the fellows must get
eir calls wholesale.

No longer will you always be welcomed in
e ham shack, except to bring meals, coffee by
e gallon, and cigarettes. Keeping meteor
ower schedules is a tense task that calls for
O distractions and a very good clock. Usually
ch party transmits for 30 seconds at very high
eed code, then listens for 30 seconds. This can
on for one to two hours. JWL usually runs
hedules constantly from the time he comes
me from work until work time the next morn-
g, with maybe two or three hours off for sleep.
e's one wreck of a man at the end of a shower.

When your new v.h.f. ham says with wild en-
usiasm that he got a "ping" from New Jersey,
ile radiantly and offer congratulations. You'll
on learn what "pings" are.

And when he locks up the store (or leaves his
) to come home in the middle of the morning
work Nebraska, don't be too surprised. It's
t part of the pattern this v.h.f. bug creates.

A few words about this matter of public rela-
ns with the friends and neighbors that I spoke
earlier. Forget it! I've tried with little success
impress my friends with the adventure of
rora and meteor bounce. But the more I talk
d explain, the more suspicious they appear—
spicious of our sanity! This attitude is *even*
nd among some h.f. amateurs not yet grasp-
; the glory of v.h.f.

Not wishing to sound like an embittered XYL
also for the sake of our children who would
so unhappy with divorced parents, a few
al words are offered in all seriousness.

No longer will you always be welcomed in the ham shack.

Like many other XYLs, there are days when I could gleefully pour kerosene on the whole rig and toss a match to it. But for the most part, it's a lot of fun to be a ham's wife, especially a v.h.f. ham. There are very few dull moments at our house. JWL doesn't exclude the other media. Single-sideband and teletype get their share of attention here.

So, when your OM says "Think I'll try getting on v.h.f. I'll just need a little two way rig and some kind of small beam," you say, "No Sir! Mister, you do it right. Go sell the car and put a kilowatt on." (He won't be satisfied until he gets it up to a *kw* anyway.) "You build a beam at least twenty feet long, or I won't hear of it!"

Then you, Madam XYL, run out and buy yourself a clothes dryer and a book on astronomy and you're set for a lot of wild, happy days. ■

Ham Hints

Quick Dip Cleans Iron Tip

Actually, there is no need for you to get out a wire brush or a file every time you are in the midst of a soldering job to clean off that black crust that forms on your iron's tip. Just keep a small container of water on the bench and plunge the hot tip into it occasionally. The rapid cooling effect will shrink the coating of crust and it will flake off easily with just the wipe of a clean cloth.

Goofing In Spanish On The Ham Bands

Martha K. Gunter, W9HIX
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Murray State College
Murray, Kentucky

Do you know Spanish? If so, you're better than me, but I want to learn. My reason is that I think it would be brilliant if I could combine DXing, rag chewing, and Spanish.

It was about two years ago that I thought maybe I could have fun with the Spanish language, and perhaps, as a result, reach some of those hard-to-get South American countries. First I consulted my old Spanish text with the intent of later composing a set speech in Spanish. Then one night late, with my glasses leaning wearily on the tip of my pug nose, I composed a speech and used it on the ham bands with humorous results.

One evening I tuned around the 15 meter band, hearing many Spanish stations on the American and DX band. I decided to see if I could receive an answer from South America by calling CQ in Spanish. I called and called, and finally received an answer from a YL in Quito, Ecuador, who had a strong, high-pitched voice. I soon began to have trouble, for she seemed to know only Spanish, and I only English. My first speech turned out all right, because I already had it written out, but when she turned it back to me the next time—I was in a spot. In the first place, I didn't know enough Spanish to understand what she said; and in the second place, I didn't know any Spanish sentences to say in return. Finally in desperation I told her, "Sorry, that's all I know. I know no more Spanish—73." I listened for a few minutes to her spot on the band hoping she knew a little English, but finally she came back rattling off in Spanish. Since I could not understand her Spanish, and I knew she couldn't understand my English; I had to QRT.

Later I obtained a *Ham's Interpreter* written by OH2QS, and that helped me extend my conversations. In this book were typical sentences one would use over amateur radio (like 'I enjoyed meeting you for the first time') translated into a number of foreign languages. I paid most attention to the Spanish sentences. Usually I used the book when my meager Spanish vocabulary ran out, and I desperately needed to know more Spanish words to finish my QSO. When I was in such a spot I often spoke the wrong sentences, and mispronounced the sentences that would have been correct . . . perhaps accidentally . . . saying something terrible!

Another amusing contact took place last year with Puerto Rico. I heard a KP4 station on the American phone band speaking Spanish, so when he stopped speaking with his contact I gave him a shout in Spanish. He came back, I gave my speech, consulted my *Ham's Interpreter,* and finally found I could say no more than 73s, and then QRT. A few days later I received his QSL, and found to my amazement that he was an American serviceman over in KP4 land. He had written in English on his card: "Enjoyed listening to you struggle with Spanish; my buddies were also having a great time listening to you."

I will never forget another contact with the Canal Zone. I was speaking to another American serviceman over in that country, and remarked casually that I knew a little Spanish. He appeared the next time not to remember what I said. Then near the end of the QSO the frequency was suddenly filled with a girl speaking fast in Spanish; presently he came back on and asked me to answer her. I didn't want to say that I had negative copy, and I knew my set speech would not be appropriate, so I answered there had been so much QRM that time that I had not copied.

Every ham who is a native of South America treats me nicely when I speak to them in Spanish. Many of them even praise my Spanish by saying, "Magnifico Español" (Magnificent Spanish), but I know that isn't so. I know my Spanish is poor, but I hope some day it will be good. Here are some of the methods I think may be of use to improve my Spanish:

1. Obtain a Spanish text and study it.
2. Get records that teach Spanish.
3. Find a tutor who knows Spanish.
4. Continue to practice my Spanish via amateur radio.
5. Listen and learn from anyone who corrects my Spanish.
6. Take a Spanish course in a school.
7. Listen to South Americans speaking Spanish over the radio in order to obtain tips on pronunciation and accent.

Maybe I will even join the group of amateurs I heard on a net the other day learning Spanish. I heard them say they meet there for an hour each day.

But meanwhile, listening on 15, you may hear me, as usual, goofing away in Spanish. ■

DX DX DX DX DX DX DX DX

URBAN LE JEUNE, JR., W2DEC
BOX 35, HAZLET, NEW JERSEY

The following certificates were issued between the period January 12th, 1961 and February 12th, 1961:

WAZ

1487	W9PVA	Bud Kopp
1488	G2FFO	R. Johnson
1489	HA5KFR	Collective Radio Station, c/o Central Radio Club
1490	GM3ASM	Stanley E. Hincks
1491	W4JNE	Richard S. Buchholz
1492	W2OCU	Harold O. Hogan, Jr.
1493	VE7AHG	Robert Sanderson
1494	HA5BU	Ordög Istvan
1495	OH9PF	Teuvo Hulkko
1496	DL6GB	Eric Linsin
1497	W2NOY	C. W. Bleichner
1498	WØAUB	W. J. Bergmann
1499	W1DGT	Elmore J. Fitz
1500	W9KXZ	Steve Eyer
1501	OE3NH	Hans Pfannhauser
1502	DL6TW	Otto Peters
1503	DL8CM	Harry Jakob
1504	W6HDF	Robert McGaughey
1505	G3LHJ	Derrick Webber
1506	SM5ATK	Gunnar Th. Forslund
1507	DJ4OP	Werner Katte

CW WPX

160	UC2AR	G. M. Radion
161	K4DRO	Tom Gallagher

SSB WPX

48	W8JIN	James W. Ringland
49	WØKFA	Clair R. Miller
50	W2HXG	George E. Fogg, Jr.
51	LA3SG	Kjell Midtseter
52	HB9TL	Jack C. Laib
53	W2FXN	Robert C. Scully
54	EI8P	J. E. Mills

WPX HONOR ROLL

PHONE WPX

V8WT	510	SP7HX	323
G3DO	476	W3AYD	314
CT1PK	449	I1CBZ	312
V9YSQ	436	W3DJZ	306
V9WHM	367	ZP5CF	306
AØHBO	363	SM3BIZ	304
V5ERY	358	F8PI	302
V9UZC	356	PY1NC	302
DL3TJ	354	EI3R	302
Y2CK	354	W9PQA	301
A5TO	353	VE1ADE	300
V8PQQ	327		

CW WPX

W2HMJ	594	W5LGG	401
W6KG	528	W9SFR	400
W8KPL	520	K4JVE	377
W9YSX	517	WØQYE	377
W5KC	505	IT1AGA	374
K6CQM	500	W5BUK	369
W1EQ	464	W9DYG	367
W2EQS	464	G2GM	365
W4OPM	464	W4AZK	365
W8LY	456	W9QGR	361
W2MUM	450	W9WIO	360
K2UKQ	447	SM5AJU	359
K6SXA	447	K2ZKU	357
W9UXO	438	UC2AA	357
W3BQA	437	VE3DIF	357
K9EAB	432	WØMCX	357
K5LIA	428	DL7CS	356
OK1MB	428	KL7MF	356
WØPGI	420	W5OLG	356
W2HO	418	K4GSS	353
W8PQQ	418	K2PFC	352
W5AWT	412	W9WCE	352
W2PTD	411	HB9TT	351
K9AGB	409	W5DA	351
W6WO	409	VK3KB	350
W5AFX	407	W6UNP	350
W3OCU	405	W1IJB	349
W2NUT	403	W3GAU	349
W8JIN	403	W9IU	344
PY4OD	402	W6YY	330

SSB WPX

TI2HP	328	W8YIN	157
HB9TL	315	K1IXG	155
K9EAB	301	W1TYQ	155
MP4BBW	300	W2YBO	155
W4OPM	284	GW2DUR	154
K2MGE	263	W2HXG	154
W8PQQ	250	K2QXG	153
W1GR	246	W2OTZ	153
W3MAC	235	W2TP	153
HB9TL	221	W2VZV	153
WØCVU	218	K2JFV	152
DL4AS	208	VE3BWY	152
K2JXY	206	W6VUW	152
W5RHW	203	W8JIN	152
W3VSU	200	W8JXY	152
XE1AE	197	W8YBZ	152
PZ1AX	189	K2TDI	151
K3HEA	181	W2BLP	151
W6BAF	170	W2GNQ	151
WØKFA	168	W9YHE	151
W8BKO	166	WØFUH	151
UA3CR	165	K6HZP	150
VE3MR	164	LA3SG	150
VE3BKL	163	W2FXN	150
YV5FK	162	W5DA	150
EI8P	160	W5PQA	150
IG9AD	160	W6TNS	150

Letters

AP Pakistan—The following letter from AP2M to W2DEO should clear up some questions about the mysterious AP4M: "AP4M is a pirate, I ascertained from P&T (the licensing authority here).

"The following stations are active on 20 and 15 meters phone and I am sure any one of them would be happy to QSO es QSL. AP2AD Ahmed, AP2MR, Rafigne, AP2Q, Aslam, AP2CK, AP2BP, AP2AC, AP2AG and, maybe, one or two more (and myself, too.)

"I am afraid I cannot forward your letter and card to AP4M—I do not know his QTH. But sure will give him your letter when we find him and put him in jail, hi.

73, Razak, AP2M"

ET2 Eritrea—The following letter is from the gang at ET2US.

There is only one QSL manager for ET2US Amateur Radio Club, Kagnew Station, A.P.O. 843, New York, New York. All QSL cards must be addressed to the above address in order to get an ET2US QSL card for DXCC or any other award necessitating an ET2US QSL card.

"It is the request of the membership of ET2US that all previous QSL managers please forward all ET2US QSL cards and other cards pertaining to ET2US to the above address. The stateside QSL manager has not proven successful at all to ET2US."

FC Corsica—F9QV/FC is now on s.s.b. with a home brew 100 watt rig. Xtal frequencies are 14294, 304, and 314 kc. (Tnx WGDXC)

6O Somali Republic—The following letter is from 6O2GM to K6CQM.

"I am 37 years old, married, three children, 9 yrs, 6 yrs, 3 yrs, girl, girl and boy in that order. Have been in radio since I was 15 years old when I started training in it. Served in the RAF during the war and am now employed by the radio service which handles all the British Diplomatic traffic. Am out here as the Deputy Engineer I/C of a high power broadcast station. Have worked on s.s.b., FSK and broadcast transmitters ranging in power from 500 watts to a megawatt. First licensed in 1947 and am a confirmed c.w. addict but like the long ragchews on phone with my particular buddies. Am a keen DXer from G-land, 220/198, WAZ phone, WAS, memorable contacts breaking the 'W' QRM from G-land to QSO ZM6AS, W6UOU/KS6, TI9CR on 20 meters. First taste of DX operating was from SU1GM in 1951 when I operated under cover with the gear in a packing case ready to hide it.

"The rig here runs 100 watts to a V-beam which is directed at the U.K. since I use the same aerial for a communication circuit. The RX is an old SX-28 which has seen better days. Hope to be on sideband with an Apache/SB-10 combination before my present tour finishes, am just waiting for a price from Heath inclusive of shipping and insurance before I order.

"The QSL policy is $1, 6 or over IRC's—both get same day attention and a 1st class air mail return, the remainder get 2nd class airmail, seamail or RSGB depending on the IRC's, but all cards in are QSL'd within a week. The balance of the QSLs in the log are confirmed as time permits since I have always QSLd all and every log contact of a QSO.

"Operating procedure is I tune about 10/15 kc high and don't normally answer breaks or tailenders. The reason is that once I start answering then everyone starts and its just a mass of QRM for the last part of each QSO as everyone tries to tailend a little earlier than the next chap.

"I get hot sometimes at some of the bad operating practice which comes from Europe and find that the W/K stations are very good, this confirms my views which I have held from the SU1GM days.

"Aim of the station is to give as many 6O2 QSO's as possible in the time I am here, that is why I rubber stamp most of them. Fondest hope—that someday everyone will have worked 6O2, then I can get down to making so many more friends and ragchew once in a while.

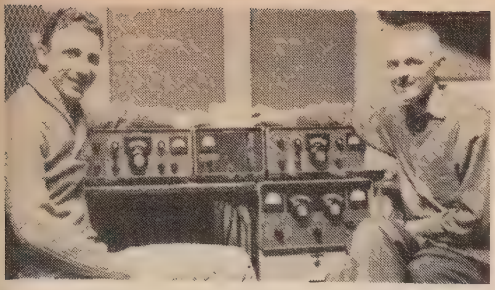
"As for what it feels like to be a much sought after station, it is very nice to know you don't have to search for a QSO, it is most annoying to know that it's no good calling that AP2CR or AC5 station since as soon as you do there is bound to be half a dozen each of DL, UA, I1 stations calling you right back, but most of all is the very subdueing thought that every mistake is heard by the waiting multitude."

Don's QTH is Don Bushe, 6O2GM, Box 164, Berbera, Northern Region, Somali Republic. (Tnx NCDXC)

Alex, VP9EP, at the rig, ready for a rare one. Alex is an electronics officer at the U.S. Naval Station at Bermuda.

9U5 Ruanda-Urundi—Along with his QSL, I received this very interesting letter from John, 9U5MC:

"My name is Jean-Pierre Decoster, alias 'Dec' (John-Jean in French). I am 30 years old since January 7th. I am married and have two daughters 7 and 6. The family is living in Belgium, and I am by myself, unfortunately. I am employed by the Government (The Belgium Government) as head of the Telecommunication system in Ruanda. In Africa since 1953. I was in Bunia (Oriental Province) during the troubled days of July 60. I took part in helping the air-lift



John, F7HC/W5VYY and Howard, K1QCJ, his QSL manager. The antenna is a three-curtain rhombic 100 feet in the air. (Tnx F7AW/K5LXK)

for evacuation of refugees from Bunia, Buta, Paulis, etc. I was lucky to reach Uganda without trouble and from there went to Ruanda-Urundi.

"I am officially licensed at 9U5ND. On the air with 5MC call since 12/10/60 mostly on cw. 14 mc, but also on phone 14 and 21 mc. Up until now, I have made 642 QSO's, 73 countries of which 46 confirmed. I have obtained the WAC and DVB (Diplome de la Ville de Brazzaville) hunting for DXCC and WAS (only 13 states left: hard to get those W/KØ and W/K/7).

"My rig is a 25 watter final 807 plate/screen modulated by pair 6L6's. V.f.o. Geloso. Rx is HRO war surplus (ex English R106). The antenna was a short piece of wire about 15 feet long and 10 feet high directed E/W. Since January 17th, I am working with a long wire about 150 feet long and 15 feet high. Directed N/S. Shack is in my hotel room and whole installation is provisional . . . since October '60 (hi). QTH is Kigali, capital 'City' of Ruanda.

"Hope my English is acceptable and wishing you all best of luck in 1961, hpy hunting and 73 QRO. John"

160 Meters

One sixty meters has shown signs of becoming a first-rate DX band. The following items from W1BB's 160 meter bulletin show why:

An unusual "opening" of 160 meters, similar to the "Good Old Days" brought much excitement and real accomplishment, when on January 14/15, between 0400—0630 GMT the band was "Hot as a Firecracker."

A *"First"* was scored by W1ME when he QSO'd UB5WF at about 0450 GMT—the first UB/W 160 QSO! Many congratulations go to him for this, but especially to UB5WF/ Vlad for being interested in 160, being on, and making this possible by his fine efforts . . . and to him we extend hearty congratulations and thanks also. . . .

This same morning W1PPN/Cliffe, made the first 1961 contact with ZC, by working ZC4AK at 0452 GMT his 559 and ZC4AK at 449, v.f.b. . . . W1ME/Johnny also worked ZC4AK next.

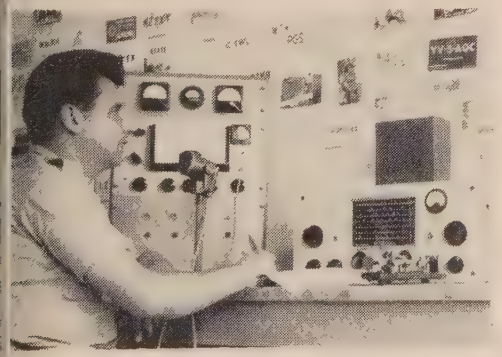
Closely following W1BB/1—(Up in Maine on the farm with 40 watt QRP rig and 520' Vee beam antenna)—worked both ZC4AK and UB5WF. Thereupon W2EQS worked UB5WF.

The following additional 160 meter DX QSOs, based on latest reports available, were made: W1BB/DL1FF, G6BQ, G6HB, G3ERB, G3CHN, G3PU, G3MBN—W1ME/DL1FF, G6BQ, G3CHN, G6HB — W1PPN/DL1FF, G6BQ, G3ERN, G3PU, G3CHN, G3NFV—K1KSH/DL1FF, G6BQ—VE1ZZ/DL1FF, G6HB, G3CHN—W2EQS/DL1FF.

Importantly, signals were way up in strength. ZC4AK/Cyprus peaked 569, and UB5WF/ Ukraine, peaked 579—G6BQ/589 and others similarly. All signals had an unusual quality making them seem somewhat of a T8 note.

Much credit goes to ZC4AK/Steve for his faithfulness, perserverance, and ability. He reports via airmail *"Bingo"*—In space of 8 hours I worked 23 stations in 8 countries and four continents. Conditions were superb. I have seldom been so delighted. To date he reports 45 G-QSOs, 15 OK's, GW3NAM, GM5RI, DL1FF, VU, BA, HB9QA, T-OD5LX-UB5WF-ZC4KV-5A2CV-W1BB/1, PPN, ME—Heard W8GDQ, ANO, W2KTR—and heard W8GDO, W2KTR and VS9AAC—a splendid record, eh fellow? ? ? Congrats Steve.

Vlad, UB5WF, previously heard W2UWD and K2BWR and QSO'd OK1EK with QRP—he uses a 40 meter *Windom* with 200 watts. This was a banner opening for him also!



These two stations have suddenly found themselves very popular since the FF8 and FQ8 split up. They are Dean, FF7AG, in Mauritania on the left and Henry, FQ8HL, in the Republic of Tchad on the right. (Tnx W9WHM)

EL4A, Ken Bale, (W7VCB) is to be congratulated for making 160 meter history with the *first!!* Liberia to USA 160 Meter QSO on record, when on January 29th, he QSO's W1BB twice . . . the first at 0557 GMT on 1820 kc—the second at 0618 GMT on 1804 kc. His signal varied with QSB from zero to 569.

Further, the following week, February 6th, during the regular 160 meter Transatlantic DX Test, he again QSO'd USA, working W2UWD, W1BB and W9PNE with signals between 229 and 559. . . .

Previous to this, he had been heard by KZ5TD one Sunday morning, 569 . . .

In March, EL4A QRTs for vacation in the USA—but will return with a 1000 watt final, to be on the air about July 1st for further 160 meter DXploits. Ken is using a Ranger and 1000' long wire antenna 100 feet high. Will have QTH on beach, on Sand Bar with very good radio propogation conditions—possibly Rhombic—50,000 acres available.

For those needing Africa/160—Here's your man, fellows! ! !

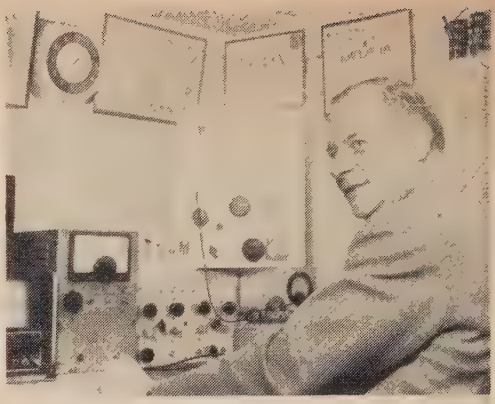
Certificates

The Tokyo Century Certificate

The Chuou Line Amateur Radio Club, the largest radio club in Tokyo, issues this certificate which consists of a Japanese style certificate and stickers, to all licensed radio amateurs who submit QSL's for QSO's and to all SWL's who have QSLs for receiving reports with 100 different Tokyo stations (for Japanese stations) or with 20 different Tokyo stations (for stations located outside Japan), as follows:

1. Any band and type emission may be used.
2. QSL's and a list of stations will be submitted with all applications.
3. 5-IRC's are requested.
4. Send all mail to: Chuou Line Amateur Radio Club, P. O. Box 23, Suginami, Tokyo, Japan.
5. Stickers will be issued for each 20 additional cards (for stations located outside Japan). 5 IRC's are requested at each time.

No, those aren't QSL cards, they're certificates, and they indicate that Gene, W6YC is an avid DXer.



The smile on Don's face is the result of a new WPX certificate hanging on the wall. With the exception of the receiver, the entire rig is home-brew. (Tnx *Torquay Times*)

The Tokyo 50-50 Certificate

For v.h.f., men another certificate will be issued to all radio amateurs and s.w.l.'s as follows: To stations located outside Japan:

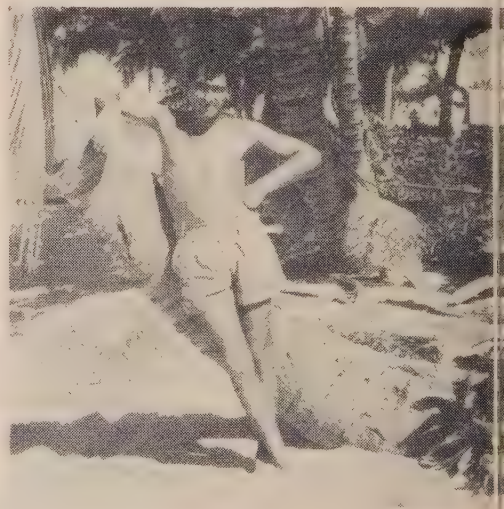
1. Confirmed contacts with any 10 different radio stations located in Tokyo on 50 mc and above bands.
2. No additional stickers will be issued.
3. Other requirements are the same as Tokyo-100 certificate. (Tnx JA1BWA)

Kodiak Award

The Kodiak Amateur Radio Club on Kodiak Island, Alaska issues an Award for having worked five (5) amateur stations located on Kodiak Island. Their mailing address is:

Kodiak Amateur Radio Club,
U.S. Naval Station, Kodiak, Alaska
Navy No. 127 c/o PM
Seattle, Washington

(Tnx FEARL (M) News)



This picture was received by Kay, K2UKQ, as we in New Jersey were digging out of over 20 inches of snow. That's David, VS9MB, holding up the palm tree on Gan, in the Maldive Islands.

SP–DX Club Award

QSO's with 15 of the following, 10 for non European applicants, will bring you the new SP DX Club Award; SP2AP, 2BE, 2LV, 3PL, 5GX, 5HS, 6AAT, 6BZ, 6FZ, 7AZ, 7HX, 8AG, 8CK, 8CP, 8EV, 8HR, 8HU, 8MJ, 9DT, 9EU, 9RF, and 9TA. Send list only, members must have received your QSL, to SP DX CLUB, Box 424, Lodz 1, Poland. (Tnx W1RWU).

"The 6X6 Award" by the Kroonstad DX Club, for proof of contact with six separate countries on each of the six continents. On each continent 3 must be on phone and 3 must be on c.w., that is, a total of 18 countries contacted on fone and 18 contacted on c.w., all different.

Endorsement seals for 12 and 18 countries on each continent and under same conditions as original award. Apply with list, log data (QSL's on hand) certified by two other amateurs or an official of a recognized RC, together with 5-IRC plus 1-IRC for each seal. $1.00 U.S. brings award Air Mail in USA. Apply Kroonstad Club, P.O. Box 387, Kroonstad, South Africa. (Tnx K6BX)

The WAOE Diploma–New Rules

This Diploma is being granted to all licensed shortwave stations in all countries and zones.

1.—Austria and adjoining countries. These have to prove, that they have made contact with three stations from the eight OE Districts (OE 1, 2, 3, 4, 5, 6, 7, 8,; OE 4 and OE 9 to be counted as one district) and at least on two different bands. One contact at least, per OE-district must have been made on the 40 and 80 meter bands. Twenty-four QSL cards must be submitted by OE stations. Foreigners send a confirmation list of 24 QSL cards endorsed by a reputable club.

2.—*Rest of European stations* conditions as in group 1 but without the 40 M or—80 M condition. Signed statement of a club for 24 QSL cards.

3.—*Stations outside of Europe.* These have to prove that one station from each of the eight OE districts on any band, have been worked. Signed statement of a club for 8 QSL cards applies here.

4.—*All confirmations* of QSO's being submitted since April 1st 1954 are valid for all three groups.

5.—*The certificate WAOE* is to be given: for c.w. or phone, or mixed.

6.—*The same station* may be worked on all bands.

7.—*All listening stations* will receive a certificate called "HAOE" when QSL cards of eight districts are submitted: 8 QSL cards for OE's or club endorsement for foreigners.

Applications for the WAOE certificate may be sent to: (enclose 10 IRC's pse) OE. V.S.V. Diplom Manager: Ing. Herbert Setz, OE8SH, Klagenfurt 1, P.O. Box 500, Austria.

Latest News

CR1Ø Timor—Tnx to the WGDXC for the following letter from CR9AU.

"CR1ØAA is on leave now, but he will be coming back to Timor in Mid-Feb. and expects to pass through enroute. While in Macau, CR9AH will get the full story on his future plans as far as amateur radio goes. It is possible that CR1ØAA will be assigned to a transmitting station on top of a plateau called Baucam, then he will have a regular source of power as well as an assortment of rhombics and high antenna masts where he can put up a good antenna. Otherwise he will probably remain in Dili using his old battery rig with its weak TV signals."

EP Iran—EP2AF is now on 10, 15 and 20 meters with beams usually between 0230-0330 GMT and 1400-1830 GMT.

ST2 SUDAN—Eric, ST2AR, writes: "I'm very sorry to say that I am QRT due to local 'difficulties' and cannot say if or when I shall be able to resume operation."

VR1 British Phoenix Islands—MP4BBW and VE7ZM will operate from here starting around March 25th using the calls VR1W and VR1Z respectively. 14347 kc will be used and they will listen for calls 10 kc lower.

The key of Ev, W1NLM, is now silent but his story, which appeared in the *NEDXA* is being presented to show what handicaps can be overcome once you put your mind to it. "The Editor regrets to inform the club of the recent passing of one of our most active and best members. Ev, 45, succumbed to a heart attack July 14, 1960 on the way to a hospital. Few people knew, but Ev did his hamming and other related activities under handicaps that would have stopped a lesser man. Ev's stamina was evidenced by the fact that he had been under a doctor's care for heart trouble for the past several years, for diabetes since age 10, and suffering from, perhaps his greatest frustrating handicap of them all, being totally blind. His greatness and his devotion to his fellow man was proved by his past duties as DX Editor of *Braille Technical Press*, a magazine for blind amateurs, radio engineers and servicemen; his duties as a member of the Board of Directors of the BTP, as President of Bethel Amateur Radio Association, his local Radio Club, and as Communications and Radio Officer for his town's CD. Ev's ham memberships included ARRL, A1-OP, FOC, TOPS, HSC and Honorary membership in Vasteras Swedish Radio Club. NEDXA extends its deepest condolences to the surviving members of his family—mother, wife, brother. The Club has lost one of its best members and the DX world, one of its staunchest competitors." *(Tnx KN1OAV)*

KG4 Guantanamo Bay—Thanks to the NCDXC for the following list of KG4 activity.
KG4AE: SSB, 20, 15, 10 meters
KG4AM: SSB (custodian KG4AP) 40 to 10 meters
KG4AB: AM, CW—100 watts, 40 to 10 meters
KG4AH: AM, 20, 15, 10 meters
KG4AV: AM and NBFM, 40 to 10 meters
KG4AC: AM 300 watts, 20, 15, 10 meters
KG4AT: AM 150 watts, 20, 15, 10 meters
KG4AP: SSB, AM & CW, 1 KW 80 to 10 meters

PX Andorra—EA2CN, EA4EP and K1HMG will travel to PX land from May 1st thru 7th and will be active on 10, 15 and 20 meter phone as PX1EP. All QSL's via EA2CN.

VS6 Hong Kong—VS6EC has returned to Hong Kong after two years in Australia. He has been reassigned his old call which at present is also being shared by his XYL, Ilo (ex DL1OV) until she receives her own call. In a QSO with a W2, Ted had a difficult time explaining this as the W2 had just worked Ilo a few days previous and thought Ted was a pirate. He will QSL for his 1958 QSO's expecially those who claim him to be their first VS6. SASE and current IRC's, old IRC's he claims are worthless. His QTH, Edward Gregory, P.O. Box 541, G.P.O. Hong Kong. (Tnx WØAUB)

Tim, W4TGA, left New York City on March 10 for a two month voyage which will take him 22,000 miles around the Atlantic. Stops along the way will be; Argentina, Capetown, Mombassa, Zanzibar, French Somalia, Suez, Egypt, Italy, Spain, Portugal and back to N.Y.C. on May 10th. Tim has a KWM-2 and is aboard the *S.S. Brasil*. Look for him on 10, 15 and 20 s.s.b. as W4TGM/MM.

Hear Abouts

Col. Jerry Branch—ex KA8KW has just received his new call at his new QTH given as follows: Col. "Jerry" Branch—WA2QCB, Box 336, Griffiss AFB, Rome, N. Y. He finds competition real tough as compared to his overseas operations but will try to make his "powerful" 130 watts input formerly used at KA8KW and KH6DMP felt by all worthy opponents. He is also curious as to why he has never once seen a KA or KW or KH6DMP card on any wall of any ham station foto? Can anyone help? Where did all those 4000 add QSLs go? If he still owes a QSL for former QSOs, he will gladly respond to a card sent to the new QTH above.

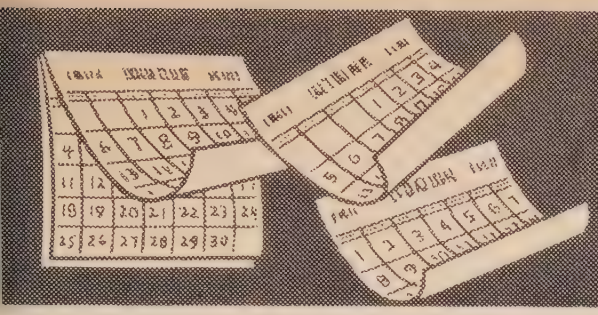
Many DX stations are anxious to earn the WAS award but have been unable to do so because of failure to contact amateurs in our so-called "rare" states. If DX stations needing certain states to earn the WAS award will forward a listing of their required states to K4TUA giving the mode of transmission and band desired, John will attempt to arrange a sked for them. He is on the air week days at 2300 to 0300 GMT between 14.0-14.1 mc on c.w. and will accept the info over the air when propagation conditions are favorable. Give him a call or send him the dope. His QTH is: John H. Grady, K4TUA, 404 North Briarcliff Road, Warner Robins, Georgia.

QTH Listings

EA4CT Pablo Hernandez, Quesado, Calvo Sotelo #7, Garachico, Tenerife, Canary Islands
EI QSL Bureau I.R.T.S. QSL Bureau, 24 Wicklow St., Dublin, Ireland
EP2AF American Embassy, APO 205, New York, N. Y. or American Embassy, Tehran, Iran
EP1AD Harold B. Leith, MAAG, APO 205, New York, N. Y.
EP2AG George H. Buchanan, c/o QSL Mgr., APO 205, New York, N. Y.
EP2AJ John Aannon, Gulf District, APO 205, New York, N. Y.
EP2AP Jim Heay, USOM-CAAG, APO 205, New York, N. Y.
EP2AQ Forence Heay, USOM-CAAG, APO 205, New York, N. Y.
EP2AT M/Sgt. Robert Leffart, MAAG, APO 205, New York, N. Y.
EP2AY Lyman M. Rundlett, Box 5045, Beirut, Lebanon
EP3HS Heinz Schmidt, c/o QSL Mgr. APO 205, New York, N. Y.
EP3RO Conrad Glade, c/o QSL Mgr. APO 205, New York, N. Y.
W2AYN/EP, EQ2AT, EP5X Frank Borsody, USOM/PSD APO 205, New York, N. Y.
FB8CQ Fort Dauphine, Madagascar
FF4AL Rupert Lloyd, BP 1712, Abidjan, Ivory Coast
FF7AG Lionel de Faultrier, Novakchott, Rep. of Mauritania
FP8DC via W1ISO
FQ8AJ Box 2023, Brazzaville, Rep. of Congo
FQ8AT Box 12, Ati, Rep. of Tchad
FQ8HI Peter Stamm, Box 235, Fort Lamy, Rep. of Tchad
FQ8HL Box 449, Fort Lamy, Rep. of Tchad
FQ8HP Box 41, Brazzaville, Republic of Congo
HK3RQ Box 584, Bogota, Colombia
HS1R Capt. L. P. Rose, Det. VA USARELM JUSMAG, APO 146, San Francisco, Calif.
JT1KAC Box 708, Ulan Bator, Mongolia
K6CQV/KS6 Box 307, Pago Pago, American Somoa
ex **KA8KW/KH6DMP** Col. Jerry Branch, WA2QCB, Box 336, Griffiss AFB, Rome, N. Y.
LA2NG/P Hiloor Norwegian Embassy, Reykjavik, Iceland
OD5CT Lyman Rundlett. Box 5045, Beirut, Lebanon
W8OLJ/PK via Project Hope, Washington, D. C.
PY7LJ Alvaro J. Pimentel, CIA Guardas, Fernando de Noronha, Brazil
PZ1AY Box 21, Moengo, Surinam
SVØWZ (Crete) via W7FTU
TI2J via K5PSO
SU1MS Mahmud A. Salam, Heidelberg-Rohrbach, Lucas Granach Str 13. Bei Wagner, W. Germany
UA9OI Radio Club Novosibirsk, Michurina Street 36, Norosibirsk, USSR
UAØLA Box Vladivostok, USSR
VP5BB Bert Berthelsen, Grand Turk, AAFB, GMRD Box 4187, Patrick AFB, Fla.
VS6EC Edward Gregory, Box 541, GPO, Hong Kong
VP7NA R. K. North, P. O. Box 5197, Nassau, N. P., Bahamas
VQ2WM Box 12, Mufulira, Northern Rhodesia
VQ5IG Box 59, Entebbe, Uganda
VR1W via MP4BBW
VR1Z via VE7ZM
ZB2AD after 1 Jan, 1961 via W3AYD
5N2ATU Box 38, Jos, North Nigeria
5N2LKZ via 5N2JKO (ex ZD2JKO)
5N2PJ via W7VEU

That's about it for this month.

73, es DX, Urb



CONTEST CALENDAR

by Frank Anzalone, W1WY
14 Sherwood Road, Stamford, Conn.

CALENDAR OF EVENTS

April 12—13	YL V.H.F.
April 15—16	R.E.F. Phone
April 15—16	Helvetia 22
April 29—30	PACC C.W.
April 29—30	USSR DX
May 6—7	PACC Phone

YL V.H.F.

Starts: 1200 EST Wednesday, April 12th.
Ends: 2400 EST Thursday, April 13th.

A new v.h.f. Contest for the fair sex only. Louisa, W5RZJ explained it all to you in her column last month.

R.E.F. Phone

Starts: 1400 GMT Saturday, April 15th.
Ends: 2200 GMT Sunday, April 16th.

The c.w. section took place over a month ago. Rules were published in February's CALENDAR. Logs go to the R.E.F. Contest Committee, Boite Postale 42-01, Paris RP, France.

Helvetia 22

Starts: 1500 GMT Saturday, April 15th.
Ends: 1700 GMT Sunday, April 16th.

This popular contest was moved to a later date to avoid it falling on Easter Sunday.

Work as many Swiss stations as you can on all bands, 3.5 thru 28 mc, both c.w. and phone. You will find most of the activity on c.w. but don't pass up phone if you want to run up a good score.

Check last month's CALENDAR for the rules and a list of the Cantons, which is essential in figuring out your score.

Activity is promised from some of the rarer Cantons. Conditions permitting, this might be the year for you to finally round out your total of 22 Cantons for that very attractive Helvetia 22 certificate.

Your logs should be postmarked no later than April 31st. Send them to: The USKA Contest Committee, Knutwil/LU, Switzerland.

PACC

C.W.
Starts: 1200 GMT Saturday, April 29th.
Ends: 2000 GMT Sunday, April 30th.

Phone
Starts: 1200 GMT Saturday, May 6th.
Ends: 2000 GMT Sunday, May 7th.

Unfortunately the PAØ boys are going to run into a bit of difficulty during the c.w. portion of their contest. The U.S.S.R. DX contest falls on the same dates this year and that's pretty tough competition.

However if you are interested in a PACC certificate, check the rules in last month's CALENDER. Mail your logs to: P.v.d. Berg, Contest Manager, Keizerstraat 54, Gouda, Netherlands.

USSR DX

Starts: 2100 GMT Saturday, April 29th.
Ends: 2100 GMT Sunday, April 30th.

Once again the U.S.S.R Federation of Radio Sports is sponsoring its annual Radio Day with its motto, "Peace to the World."

Rules, awards and etc are essentially the same as last year, but the date has been moved up a week, making it a serious conflict with the popular PACC c.w. week-end.

1. This is a c.w. contest only, 3.5 thru 28 mc.
2. The usual six digit contest number exchange, RST plus a progressive contact serial number, starting with 001.
3. The same station can be worked once on each band.
4. Each contact counts one point.
5. Your country total however is the number of countries worked on all bands, not the sum total on each band.
6. Your final score therefore is the total number of contact points on all bands multiplied by the number of different countries worked on all bands.

Awards will be made on the basis of all band operation. In addition however, single band awards will be given for 3.5 and 7 mc operation. Awards will be made to both single and multi-operator stations in each country as follows:

1st Place—A 1st degree certificate and a contest badge.

[*Continued on page 101*]

A Preliminary Report:
1960 *CQ* WW DX Contest

By Frank Anzalone, W1WY
Chairman, CQ Contest Committee

ANY elaboration on the miserable week-end we had for the Phone section of the Contest, would be anti-climatic at this late date. George Jacobs had predicted a disturbance a day or so after the contest period, but unfortunately it showed up earlier, as we all sadly found out.

The trans-Atlantic path was almost non-existent on any band. The corresponding lower scores will attest to this fact. You're just not going to build up a big total without a good run of Europeans on the high bands.

Said Tony and the gang at W3AOH, "a maximum effort and no equipment failure still yielded the lowest score ever."

In spite of this Jim, W1FZ found it "a very enjoyable contest even tho condx were very poor."

And Larry, W3JTC (of SVØWP fame) "saved the day by using s.s.b. almost exclusively, only 4 contacts on a.m."

Without a doubt s.s.b. was the more popular mode but the use of a.m. was also necessary since the majority of foreign stations have not as yet converted.

Scores of logs from Europe and the near East did not have a single W/K contact. Altho disappointing, this did not prevent them from having a merry ole time among themselves. Which proves the merits of a world wide contest.

British Virgin Islands—VP2VH-DXpedition by VP9L and gang during the phone section. Mule back mobile—W2YTI, VP9EN and VP9BN at the mike. Also on the trip were; W1NBA and W2YTH.

For the c.w. section, W3ASK predicted "below normal conditions," and he hit the forecast pretty much on the nose. However it was a much better week-end than we had the previous month and fairly good openings to Europe were experienced on 10 and 15, from right after daybreak to about noon on 10 and a little later on 15.

Conditions on 40 and 80 were about average, and depending on your equipment, were capable of producing some good multipliers and scores.

Bob, K2DGT ran up over 300 contacts on 7 mc and worked JA1FC and JA1YL with his beam pointing south at 4:30 in the afternoon. He was working Europeans as early as 3:30 but then who has a 3 element job on 7 mc in his back yard.

Ruanda-Urundi—9U5PD—Paul was quite active in the phone week-end, 376 QSO's to be exact. Not too many of the U.S.A. boys got through to him. That's Geloso equipment he is using.

However the normally dependable 20 meter band was not so dependable this time. "It was a struggle all the way," says Andy, W1GYE.

Openings, especially to Europe, were spotty and for only short periods. This however did not hold true for all sections and seemed to improve as you went farther south. When the trans-Atlantic path wasn't open, some of the wise boys pointed their beams south and came up with some surprising European contacts.

Harris, W3IPO and Ed, K6VTQ want us to get out of the Fall months and schedule our contest in the Spring. Fine, but what do we do about the ARRL marathon that occupies February and March? Actually it's the breaks, we've had some pretty good week-ends in October and November. These are the kind of conditions we

have to look forward to for the next few years. And it's going to get worse before it starts to improve.

W7VY thinks that foreign participation has fallen off. It's not so Gene, you just were not hearing them. The activity in Europe, the USSR and Japan was tremendous, especially during the c.w. section.

As a matter of fact we are still receiving packages, and I mean packages, from Box 88, Moscow. This activity was mostly due to the efforts of I. Demianov, the Secretary General of the Central Radio Club. Ivan saw fit to send the logs directly to my home QTH. To make it more interesting, many are big fat scores by Club stations, and in Russian script. So you think you have problems. Not to mention the

Mozambique-CR7CR-Carlos is another phone man. A goodly portion of his 147 contacts were with the land of the kilowatt.

usual quota via West Hartford. I'm disappointed however that Ellen or John did not take time out to score them before sending them on to me.

There was some undue confusion about the status of KH6 and KL7, but they are still on the DX Country List and therefore retain their original status.

In Europe and Asia there was the question regarding UD6, UF6 and UG6. Since they are not on the WAE list they must be regarded as in Asia. After all the DARC should know, they are a lot closer to the situation than we are.

Then there is the Antarctica situation. You can work half a dozen different prefixes down there, (OR4TX, VKØPM and etc.) but it still adds up to only one country. Altho it's possible to gain several Zones. Incidently VKØPM is in Antarctica, not Heard or Macquarie.

Some of the USSR boys were taking extra country credit for Tannu Tuva, (UAØKYA). No can do, it's still considered as only part of Asiatic Russia. But Zone 23 credit is possible of course.

With all the SVØs on the air, the picture here was also confused. Our records show that SVØWI, ØWL and ØWQ are in Greece and that SVØWO, ØWT and ØWZ are in Crete.

Up in the frozen North it's LA1LG/p, 1NG/p and 8YB/p on Jan Mayen, while Spitzbergen was represented by LA2DE/p and 2DR/p.

Some of the fellows are still taking three point

Reunion Islands-FR7ZD-Guy made 200 fellows happy in the c.w. section. Only a handful of W/Ks got through to him on 14 mc but over a dozen of us made it on 21 mc.

credit for some North American contacts. Islands or mainland it's still only one point.

A final item that cut into many scores were duplicate contacts. This was mostly evident in multi-operator stations, who evidently were lax in maintaining an accurate check list. The gang at W3AOH licked this problem by making up their own log sheets. These were sectioned off alphabetically according to countries. The next operator coming on duty could tell at a glance what stations had been worked. Future multi-operator groups should keep this in mind.

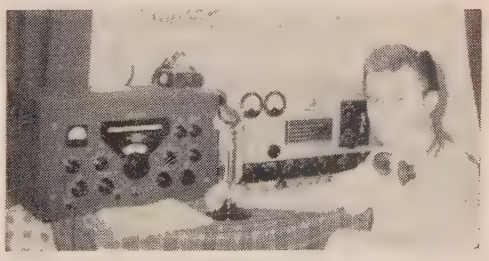
So if you find your score shaved down a bit, it could possibly be due to any of the above corrections.

Some DX Clubs are still negligent in observing Rule XI 7a, which states that in order to be eligible for the *CQ* Plaque award, the club score must be submitted along with a list of their participating members and their scores. We are going to list all the club scores but if your club is in contention for the Plaque, your secretary had better adhere to the above requirement.

Activity and returns from "south of the border" again leaves much to be desired. And we still can't understand what happens to our cousins "down under" during our contest period.

For that matter the percentage of returns from the middle sector of this country are pretty ridiculous when compared to the known activity.

[*Continued on page 108*]



Bahrain Island-MP4BCV-Brian was on in both sections of the Contest. He had exactly 200 & 1 contacts in the phone section, without a single W/K in the lot. His total for the c.w. portion was 168 QSO's with a few W/Ks on 14 mc. Brian is now QRT back in England.

sideband sideband sideband

SIDEBAND

Irv and Dorothy Strauber, K2HEA/K2MC
12 Elm Street, Lynbrook, New York

SSB DX HONOR ROLL

TI2HP	230	K2FW	167
W6UOU	226	4X4DK	161
VQ4ERR	212	K6LGF	160
PY4TK	204	K8RTW	151
HB9TL	203	K2HEA	152
W6PXH	202	PZ1AX	140
W7VEU	202	W6VUW	136
K2MGE	198	W2YBO	135
W6RKP	196	K2TDI	134
W6WNE	196	W2MAF	129
WØQVZ	190	K1IXG	126
W6BAF	188	K6MLS	125
VK3AHO	185	W1JSS	125
K9EAB	181	W1AOL	125
W2ZX	180	W6UPP	122
W5AFX	177	W3COG	116
W2FXN	177	W9CYL	115
MP4BBW	177	G6LX	104
K4TJL	175	W4ERZ/1	103
W2LV	174	W2SKE	101
W5IYU	174	K4JEY	100

HB9TL and W7VEU Earn "200" Certificates

We have a double pleasure this month in bringing you news of the recipients of the "Worked 200" Certificates. Jack Laib, HB9TL, and Bud Shearer, W7VEU, each submitted sufficient and proper cards to qualify for Certificates #10 and #11 respectively. As every active sideband DXer knows, Jack is one of Europe's top operators. Although he has been on sideband for only two years, Jack quickly caught up with and then surpassed many of sideband's leading DXers until today he is fifth on the DX Honor Roll. Engaged in the manufacture of textiles in his native Amriswil, Jack learned part of his profession during a stay in the States about four years ago and numbers many Americans among his personal friends.

Bud, W7VEU, is equally well known throughout the DX world, not only as a courteous and skillful operator but also as the Editor of the Willamette Valley DX Club Bulletin. The Club consists of DXers primarily in the Oregon and Washington state areas but the Bulletin is eagerly read by amateurs in many parts of the world.

To both these outstanding DXers, we offer the congratulations of the sideband fraternity.

Working their way up to the top with "Worked 50" Certificates this month were ZL2GX, K1IFS/KL7, K5QWZ, and W5KC. Just a step ahead of them was GW2DUR who earned his "Worked 75" Certificate. Filling up the waiting frames with "Worked 100" Certificates were W2SKE, W4ERZ/1, G6LX, K4JEY, and PZ1AX who submitted sufficient cards to earn the "Worked 125" sticker as well. VE3ES pasted the "Worked 150" sticker on his certificate while MP4BBW, W2FXN, VK3AHO, and K4TJL moved up to the top of the list with enough confirmations for "Worked 175" stickers. A new sticker had to be made up to keep up with the totals of TI2HP and W6UOU who each earned the "Worked 225" sticker even before it was available for mailing. Who would have thought a scant two years ago that not only could we work 200 countries on two-way sideband but also activity has been so great that some of our top sidebanders are well on their way to 300! Fine business, gentlemen; keep up the good work!

WAZ-SSB

With the appearance of UA3FE/Ø in Zone 23, UAØLA in Zone 19 and UA9OI in Zone 18, many sidebanders throughout the world have finally been able to achieve the distinction of Working All Zones on sideband. In answer to many inquiries, we are happy to inform you that a certificate separately indorsed and separately numbered for WAZ-SSB will be issued by our DX Editor, Urban LeJeune, W2DEC, upon receipt of the proper confirmations. May we point out that this column has nothing to do with the issuance of either WPX or WAZ certificates; they are all capably handled by W2DEC.

Report Relaying

We've been hearing many comments lately about this matter of relaying of reports in a pile-up. As most of you know, a contact is the exchange of reports directly between the two stations involved. Conscientious DXers do not consider a contact completed until they themselves have copied the report directly. We cannot and will not act as policemen on the bands; we leave it to the integrity of DX operators to ignore the relaying of reports and make sure that they, on their own, have completed a satisfactory contact!

A Code Of DX Ethics

We have tried conscientiously to report on Sideband without taking sides, without favoring groups, without pressuring or being pressured. However, the situation that now exists among the DX operators, particularly on the DX bands, calls for some remedial action—and FAST! No one has attempted to count the number of DX operators active on s.s.b., but the count is increasing daily. As a group they leave a lot to be desired!

Russ, K1LRB, 17-year-old Greenfield, Mass. sideBander, who is QSL manager for HK3SO. Russ likes DX, traffic, and working YLs on SSB.

The hunt for the exotic QSL has so infected many of our DX operators that good manners and proper operating techniques have been thrown to the four winds. The "smart" operator who breaks in out of turn; who calls without a break to listen for reports being given; who deliberately turns up his audio gain to attempt to call in over another station who is in contact; who acts as if he, and he alone, is entitled to the frequency, is teaching his listeners to do the same. It is these infantile operators who constitute the greatest danger to DX operating. The barroom tactics of certain of our DX chasers, both old and new, are setting the style for 1961 DX operating. Result? The foreign DX operators are leaving the bands in large numbers and finding new countries to work is getting more and more difficult. Foreign DXers are just not interested in fighting off hordes of Americans who seem to live only for the "rare" QSL card.

We had long thought that the QSL card was the final courtesy of a radio contact; today it has taken on a new significance. Grown-up men have gone through ridiculous extremes to collect these little pieces of paper; adults display behaviour patterns that border on the ridiculous. You have only to listen to a DX pile up to realize the childishness of some of the operators. No wonder foreign DXers are quitting in disgust.

We are not alone in our concern for the future of DX operating; numerous letters have been received from serious DX men who are very much disturbed by the turn of events and the effect on future DX operating.

We think that it is high time to call a halt and do something concrete about this ever growing problem. Without eliminating the element of competition that lends spice to the chase, we must come up with an answer to the problem of the human element; the element that operates without regard or consideration for the other operators.

To this end, we propose that the numerous active DX associations and clubs, both here and abroad, begin consideration of a Code of DX Ethics. This Code would be used to guide the DX operators everywhere in the proper manner of working DX.

We are writing to the following DX groups; NEDXA, NJDXA, West Gulf DXA, Ohio Valley DXA, Williamette Valley DXA, No. California DXA, So. California DXA, South Eastern DXA, Mark IV DXA, and DX chairmen of other interested DX organizations. If you have any suggestions, please write to us. Your thoughts and ideas will be carefully screened for inclusion in the Code.

Fifth Annual CQ SSB DX Contest

Our big contest has come and gone and following in its wake is a host of logs, comments and suggestions. In line with the current trend, conditions during the weekend of Jan. 28-29 showed very little improvement over the preceding months. This, along with the fact that many, many more W/K operators participated in this year's contest, served to make the working of DX prefixes all the more difficult. We will discuss the contest in more detail when all the logs have been received and tabulated. Among the top scorers whose logs have been received are the calls of W2VCZ, ZS5JY, W3JNN, K6CTV, KH6IJ, KP4ATU, TG9AD, DL3LL, W1ONK, K6VVA, and K2YDZ/4. These and many others achieved very fine scores despite band conditions and the fierce competition. We are eagerly awaiting the remainder of the logs so that we can get down to business and find out who are the top sideband contest men in the world.

Sideband Standards

Have you ever heard a station with what sounded like a lot of carrier and no unwanted sideband suppression? Did you hesitate to call him or break in to report his difficulties because you weren't sure of the standards that a good signal should meet?

Without going into a long technical discussion, we feel that a good sideband transmitter should be capable of meeting the following minimum standards.

1. **Carrier Suppression.** Since, in single sideband, the receiver will re-insert the carrier removed or suppressed at the transmitter, any residual amounts of carrier being transmitted will appear as a beat note when the receiver is tuned to the frequency of the carrier. The pitch of the note will vary with the

Two very popular sideband operators in Capetown, Union of South Africa, are Ron, ZS1NE, and Hector, ZS1OS.

Memphis, Tenn. numbers many fine sideband enthusiasts, among them, ED, W4LHD, who consistently puts out a clean, strong signal with his KWS-1 and TA-33.

amount of detuning of the receiver from "zero beat". The louder the beat note, the more residual is being transmitted. Since no sideband transmitter completely removes all the carrier, we must set a limit as to the amount of carrier that should be permitted. *It recommended that the carrier be suppressed at least forty (40) db below peak power output.* However, if your transmitter is capable of more suppression, it is to your advantage to see that it is used to its maximum.

2. **Unwanted Sideband Suppression.** The essence of single sideband is the theoretical complete suppression of the unwanted sideband. We know that the two sidebands contain identical information so the removal of one does not affect the intelligence. The suppression of the one sideband, reducing the frequency spectrum needed for a QSO, enable more QSO's to be carried on in each band. In fact, two QSO's are often carried on using one frequency, each using opposite sidebands. This can only be done if there is satisfactory sideband suppression. A minimum practical value would be at least 30 db below peak power output of the transmitted wanted sideband. Of course, more suppression than that is possible and should be the order of the day.

So, the next time you hear a sideband signal, check the strength of the suppressed carrier and the amount of suppression of the unwanted sideband. If it doesn't meet these minimum standards, drop in on the frequency and acquaint the operator with the sideband facts of life. Chances are he'll welcome the information.

Russian Expedition

Thanks to a long and well written letter from Leo, UA3CR, here is some first-hand information on the Russian SSB DXpedition which started off in such a big way by giving Zone 23 contacts to sidebanders. Leo wrote that "This is the first SSB DXpedition in the USSR. The aim is to take part in the CQ SSB DX Contest, to give a chance for WAZ-SSB. In addition we want to show and to tell hams in Tuva what SSB is and which advantages it has. The DXpedition was organized and financed by the Federation of Radio Amateur Sport of USSR. The Equipment consists of a home built 100 watt PEP exciter (rig and power supply are in one box); transmitter was built by UA3CG (a YL), UA3FE, and myself. This rig will travel through all Soviet Union Republics which are not represented on SSB. Receiver is a commercial (10 tubes) one plus h.m. adapter with mechanical filter and product detector (made by UA3FU). Antennas are a windom and a long wire (local ant. of UAØKYA).

"Operator Seva, UA3FE, works from club station in city Kizyl—UAØKYA. Seva left Moscow for Tuva on 25th of Jan. (by plane) and his first QSO was on next day on 26th of Jan. at 11:00 GMT. In two days, he built PA on TY-13 (?) (like 813) tube with 1100 plate voltage and took part in contest with power about 250 watts.

"Conditions are very poor. He reported that W/K come through there for 1 or 2 hours during 24 hours; West Coast about 0600-0800 GMT and East Coast from 1200 to 1300 GMT. Sometimes West Coast goes about 0200-0300 GMT.

"It was planned Seva's coming back on 6th of Feb. but under request of many hams, he stay there till 16th or 17th of Feb. QSLs of UA3FE/Ø will be sent just after Seva coming back to Moscow. Cards will be sent through bureau if we do not have SAE."

Many thanks to Leo for bringing us up to date on this DXpedition. Further information indicates that the equipment will go on to UM8, UI8, and UJ8, starting shortly after Seva's return from Tuva. Needless to say, much excitement has been generated by this endeavor. DXers who have waited many years to work Zone 23 can now rest easy; newcomers to DXing have a rare zone thanks to this sideband operation. All in all, sideband operators throughout the world are grateful to the amateurs in the Soviet Union who planned and executed this DXpedition in such an efficient fashion.

RE: ALC

It's been too long since that booming signal from HR2WC was heard giving many of us a new country but some of his friends have had the pleasure of talking with Wayne from his new station, K4ZZK, in beautiful Miami. We'd like to introduce Wayne in a new role—technical writer. We hope that he will favor us with more of his "know-how" from time to time.

Wayne has a very interesting modification for any linear that will increase your talk power without overdriving and the attendant distortion.

It is a wonder that a.l.c. is not more widely used in amateur s.s.b. gear. It is more of a wonder since it is so easy and inexpensive (I have to add this all important word) either to build into the set originally or install into existing equipment.

The circuit shown is not my own but one developed by the Collins engineers and used in

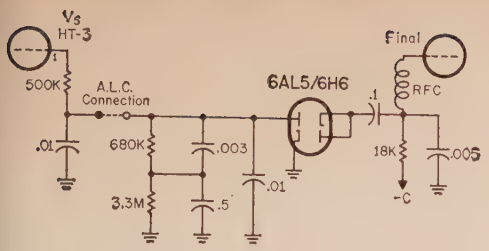


Fig. 1—Simple automatic level control circuit that may be added to most sideband rigs.

their amateur and commercial s.s.b. transmitters for a number of years. Its main feature outside of the circuit simplicity is that the operation is automatic and there are no adjustments to make. It is controlled by the mike gain. The more gain the more compression. It is impossible to overdrive the linear amplifier. The practical limit is 10-12 db which is quite worthwhile in holding things down below the splatter level. The average voice level is also raised by that much or in more understandable terms, two S units on the other end. Putting it another way, it makes a 100 watt transmitter sound like 1 kw which are terms anyone can understand.

This a.l.c. system can only be applied to an amplifier operating in Class AB1, i.e. one that is not driven into the positive grid current region. This covers the great majority of linears in amateur s.s.b. service so it should find wide application. The a.l.c. voltage is obtained from rectifying the positive grid current peaks. When the drive on the amplifier is such that no grid current is drawn, there is no a.l.c. voltage developed. Drive producing positive grid current peaks is held down as these peaks are rectified and the resultant a.l.c. bias voltage is fed back to the controlled r.f. drive stage or stages and their gain reduced.

The 6AL5 or 6H6 a.l.c. rectifier tube along with the time constant network and coupling capacitor can be tucked away in some odd corner of the amplifier and supplied with filament voltage and an output lead to the exciter. If one wants to make it just a little more compact than it already is and without the need for filament voltage, 1N459 diodes can be used in place of the tube.

Now for connecting to the exciter. With a Collins 32S-1 or KWM-2 it is easy; there is a connection on the back! The later KWM-1s also have such a connection at pin #19. For the earlier KWM-1's just run a wire from V_{10} pin 7 to C_{169} which will bring it up to date and give you the a.l.c. connection at pin #19. For the HT-32, I connected to V_5 pin 1 as shown in fig. 1. This can be done by wrapping the resistor lead around the tube pin if you don't want to try to get to the socket base which is quite a job in itself. Connection to other exciters can be made in a similar manner, preferable to the first amplifier following the balanced modulator.

Some linear amplifiers have a blocking bias that drops the plate current to zero when not being vox operated. This messes up the a.l.c. action as I found out when trying to apply it to an HT-33, for example. This was overcome by leaving the bias fixed at the operating value and switching the screens to ground thru a vox operated relay. I used some extra contacts on one of the coaxial relays in this case.

April Is Convention Time

With three major conventions set for April, sidebanders will have plenty of opportunity to get together with their fellow enthusiasts and meet, in person, many of the fine people they have contacted over the air. On April 7, 8, and 9, we will be way down South in Chattanooga, Tennessee, at the Delta Division Convention. Dr. Wernher Von Braun as banquet speaker stamps this as a very important occasion indeed. Our program topic will, of course, be "Single Sideband" and we will be followed by many fine speakers such as Sam Harris on "VHF"; Don Chesser on "DX," and Andy Andros on "Antennas." The SSBARA will sponsor a get-together for sidebanders just prior to the Banquet. Bert, W4MF, General Chairman, advised us that the Grand Prize will be a complete Hallicrafter s.s.b. station worth $1000—lots of other prizes too!

April 8 and 9 are the dates of the well known New England Division Convention at Swampscott, Mass. Ernie Coons, W1JLN, Chairman of this very popular event, has planned a Dutch Treat SSB Dinner on the 8th to precede an evening of dancing and gaiety with entertainment by the Show Toppers, a group appearing nightly at a well known Boston hotel. On Sunday, the 9th, the Committee has arranged for a wealth of technical information to be dispensed during forums tailored to fit every ham's taste.

The Dayton Hamvention is so eagerly awaited each year that we needn't try to sell you on this one. However, this year's event on April 28-29 bids fair to outdo all previous efforts. The DX forum will boast such luminaries as Urban Le Jeune, *CQ*'s own DX editor; Glen Ward, ex-9N1GW; and, almost direct from Bahrein Island, Ian Cable, MP4BBW. What a great group! The Sideband Forum will be moderated by Ye Editors and will be enhanced by the presence of such top names as Fritz Francke of Hallicrafters, Jim Taylor of Collins, Wes Schum of Central Electronics and others. Each will speak briefly on various aspects of sideband—advantages of v.h.f. sideband; filter vs. phasing s.s.b. generation; causes and effects of s.s.b. distortion; and design considerations of s.s.b. receivers. We guarantee that you will leave the forum with plenty of sideband food for thought. There will, naturally, be other forums which will interest, inform, and please everyone. The SSBARA will again hold Open House for members and friends. The windup of the Dayton Hamvention will be a mammoth banquet with a terrific lineup of prizes. We look forward to meeting many of you either at Chattanooga or Dayton and hope you'll come up and identify yourselves.

73, Irv and Dorothy

CHARLES J. SCHAUERS, W6QLV/
CQ MAGAZINE, 300 WEST 43RD ST., NEW YORK 36, N.

ham clinic

Power Supplies

The ham who designs and constructs power supplies for any ham equipment requirement knows that the design steps seldom vary.

After determining voltage and current needs, he will first choose the proper transformer. Next, he will determine his filtering requirements and proceed to pick the proper choke(s) capacitors etc.; keeping in mind the particular rectifier circuit (tubes or selenium rectifiers) he will use. Then he will calculate bleeder resistor requirements and perhaps add some voltage regulation.

A well designed power supply will have good regulation under load. Capacitance-input filters may be fine for increasing output voltage but the regulation is generally poor. This is the reason that one usually finds choke-input filters in *most* ham power supplies—regulation is better.

For better voltage regulation, input *swinging* chokes are often used. These are designed to have an optimum value at no load and a critical value at full load. This enables peak-to-average current ratio control over a very wide range of varying load conditions.

To prevent choke to ground arcing in high voltage supplies, the choke is often installed in the negative or ground side of the supply, rather than in the positive or "high" side.

Bleeder Resistors

Many hams (according to letters received) do not understand that the bleeder used in nearly all power supplies can not only be used as a voltage divider but is also there to provide a constant load to other power supply components. When the output of a power supply is loaded down, the current flowing through the bleeder is much less than when unloaded. For this reason, the designer always specifies a bleeder whose power rating in watts is generally double that calculated for a full load condition. Bleeders generally get hot because they dissipate heat, but they should not "glow in the dark."

The bleeder will also discharge filter capacitors, but for *safety's* sake, should not be trusted to do so when you are working on the supply. Bleeders do have a nasty "habit" of opening up when least expected to do so. When a bleeder goes out, so does regulation. The ham on his toes can "spot" the condition when he suddenly finds his final plate voltage meter needle taking *larger* scale excursions when a rig is modulated or keyed.

Most good radio handbooks give the design data for calculating power supply filter component values for minimum ripple.

In small low current supplies, the usual choke is sometimes replaced by resistance, but you will note that filter capacitance values are increased to very high values (except in some oscilloscope power supplies where only a few micro-amperes of anode current are required).

Mobile Supplies

With the advent of transistors, vibrator and dynamotor supplies used in mobile work are gradually but surely taking a back seat. This is very understandable when the efficiencies of each are compared. The transistor supply not only operates at top efficiency but it is quiet and occupies little mounting space. Futhermore, if there is good air circulation around it, one can expect up to *five times* the trouble-free service as compared to dynamotor or vibrator supplies.

Overloading either a vibrator or dynamotor supply will usually make it inoperative in a very short time. However, an overload on a well designed transistor supply will simply "turn it off."

Vibrators can be replaced by transistors merely by modifying the transformer in the vibrator supply. (See *Popular Electronics* October 1960 for one approach to accomplishing the change).

The usual transistor supply for generating voltages from 250 volts d.c. at 100 ma and up, generally uses two power transistors in a switching oscillatory circuit. The frequency at which the switching takes place varies, but is usually in the a.f. spectrum (1500 to 3000 cycles). Sometimes there is some receiver feed-through of the signal generated by the transistors. This can usually be eliminated by using a good pi type filter which will attenuate the particular feed-through frequency. A small low value iron core choke in conjunction with two properly sized condensers will stop the undesirable noise.

Trouble-Shooting

Trouble-shooting power supplies I have found, is relatively an easy task because of the few components involved.

No output voltage can be due to a blown fuse; open high voltage secondary winding of

the power transformer; open choke(s); or a bad rectifier tube or element. It can also be due to a shorted filter component; in this case the fuse would more than likely blow.

After discharging filter capacitors to ground, an ohmmeter can be used as an effective fault finding tool.

Transformer windings can be checked through the rectifier tube(s) socket holes.

An open bleeder can be detected quickly as well as an open or shorted choke by disconnecting one end of either and applying the ohmmeter test prods.

Filter condensers when disconnected (*after* discharge) can be checked out reasonably well with an ohmmeter (switched to high scale). Shorted condensers will show a zero or near zero resistance reading. Open condensers will show no reading (infinity) at all. A good condenser will show on the meter as a "kick" of the needle with gradual "die down" to open circuit. Electrolytic capacitors will of course exhibit slower "die down" than their paper "brothers."

Condensers suspected of leakage should be checked on a good condenser tester (under load).

Much ham equipment will contain voltage regulator (VR) tubes of various sizes. These, contrary to minority opinion *do* often go bad. Because they glow does not mean that they are regulating properly, although this is one test applied to their operation.

VR tubes should always be checked with a reliable VR checker which will let you know quickly the worth of any particular tube.

As time goes on we will see the replacement of rectifier tubes such as the 5R4GY, 816, 866, 5U4GB etc., with silicon rectifier counterparts. The latter do not need filament voltage, operate cooler and are much more efficient because of the low internal voltage drop which characterizes them.

International Rectifier Corp., Sarkes-Tarzian and other manufacturers have already made available direct replacement selenium plug-in units for most rectifier tubes. A note to either of these companies will bring you full replacement information.

Many more thoughts could be expressed here on power supplies (especially for the Novice or the ham-to-be), but space precludes them.

Now a word on surplus power transformers. I have little doubt that there are many wonderful surplus power transformer bargains available—but they are only bargains if the seller has full data on them. Be careful when purchasing surplus transformers and do not get the idea that just because a transformer is large that it has a high voltage and current capability.

If a transformer has been overloaded at one time or other, you can usually detect this by looking for leaking transformer oil and paint blisters.

Always try to obtain a transformer which has the standard color-coded leads or marked metal terminal connections; and do not do as one young tyro did: he tried to make up a "high voltage supply" using an audio transformer and other components!

Observation

In this day of technical change, there are those among us who refuse to acknowledge the fact that they are gradually being "pushed" to the rear technically and scientifically by newcomers who think in terms of s.s.b., transistors, u.h.f. and s.h.f., satellite radio relay systems and so on.

To keep up with our ever-changing technical picture requires more than just a little reading . . . it requires study and practice.

Any good electronics engineer worth his "salt" will tell you that the technical advancements have been coming so fast and so furious during the last 10 years that they require a lot of "off the job" effort to keep up with them.

Besides attending electronic shows, lectures and pursuing special courses offered at most universities, the average engineer must put in a lot of home-study. If he doesn't he will end up on the short end of the "pay stick."

The ham who is interested in just a little more than communicating with fellow amateurs must devote some of his spare time to keeping abreast of what is happening technically in his hobby. Of course, those who belong to the League and who read *CQ* do have an advantage over those who do not; there is little doubt that they enjoy the hobby of ham radio more. However, the ham who thinks in modern terms of design and construction, and who tries out the *new* things is the guy on whom the ham fraternity at large must depend for amateur radio technical progress. Without him we more than likely would not use s.s.b., ultra high frequency techniques, TV etc., as we do today.

Observed: we hams cannot continue to rest on our "technical laurels" if we are to continue to progress. There are too many of us who have the know-how but not the desire to contribute to technical advancement. We must try the *unknown* and spend a little more time in coordinated technical effort or we stand (for example) a big chance of losing some of the u.h.f. and s.h.f. frequencies now allocated to us. We must use them to keep them, and to use them we must do our own technical development; next year may be too late.

Questions

Soldering Iron Tip—"I have a soldering iron with an old tip frozen in it. I've tried everything but can't get the dern thing out. What do suggest?"

First, don't try to take the tip out when the iron is cold. But before you heat up the iron apply a few drops of penetrating oil around the tip. Let it stand overnight. Then heat up the iron. When it is hot, place in a vise and with a pair of pipe pliers turn the tip (with the set-

screw already out), at the same time tugging straight up. It *should* come out.

When you get the bit out let the iron cool, then clean out the barrel with a rag dipped in cleaning solvent (*not* carbon-tet). Next, buy a Hexacon "Durotherm" bit and insert it in the barrel. Your bit freezing days are over as well as your constant battle with tinning.

2 Meter Oscillator—"Please publish a circuit of a really stable crystal (overtone) oscillator that will have a 72 mc output."

See Figure 1. This circuit works fine if you use a good active overtone crystal. You will find that this circuit is thermally stable to better than one part in 1,000,000!

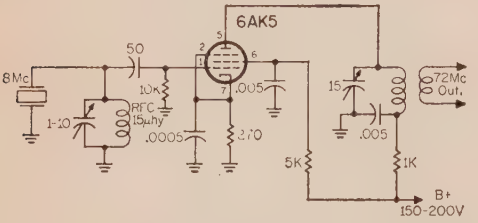


Fig. 1—Diagram of an extremely stable overtone crystal oscillator with 72 mc output.

Dual Converter—"Where can I find a diagram of a converter that works on both 2 and 6 meters but uses only one conversion crystal?"

Suggest you get a copy of the *VHF Amateur* October 1960 issue. On page 7 you will find a terrific article on a dual 2 and 6 meter converter which uses only one crystal. The article is by LU3DCA. He certainly did do a "bang up" job on this one.

Surplus Part Identification—"I have a number of surplus transformers of all kinds. What is the best way to establish identification?"

First off, I would suggest that you write the manufacturer if given on the name plate. Be sure to send all other data appearing on the plate or transformer. HAM CLINIC can supply the address for any transformer manufacturer (still in business) in the United States. Please do not ask us to give you the information on a particular surplus transformer if it is 5 years or more old. We simply do not have it.

If you know from what equipment your transformer came you might try writing the Bill Slep Co., PO Box 178, Ellenton, Fla. He may have a complete diagram on the equipment which may or may not contain full information on the transformer.

Mobile Modulation Monitor—"Please give me a simple transistor unit diagram for monitoring my a.m. rig in my car. All I want to see or hear is that I am modulating."

See Figure 2. By changing L_1 to a loopstick and C_1 to a small 365 mmf variable capacitor, the unit can also be used as a small BC set or for Conelrad monitoring.

Tubes—A question relative to the use of a *particular* brand of tube was raised by one of our readers after he read our December 1960 column on the HQ-110.

The recommendation that a particular make of tube be used in the HQ-110 was based on the set *manufacturer's* recommendation. No doubt, when a set is aligned with a particular set of tubes of specific manufacture, replacement tubes should be of the *same* make. On the other hand, JAN approved tubes of the same type can be used *without* reference to any specific make.

HAM CLINIC does not suggest selective buying based on one recommendation. It does however, accept the set manufacturer's recommendation as to what tubes will work best in a particular receiver, transmitter etc.

Thanks Tom, WA2KUB, for a real enlightening and enjoyable letter pointing out the need for the standardization of tube characteristics enabling the inter-changeability of tubes (of the same type) but of different manufacture, without "fuss or muss."

DX-40 A.F. Distortion—"Can you give me some information concerning af distortion reported in my DX-40?"

Yes. First check the 12AX7 and 6DE7 tubes. Do try others. Next, check all af coupling condensers. Check the microphone connections as well as the microphone itself—try another mike. Check the electrolytic condensers and the 20K ohm bleeder resistors; if these are defective you will have hum and distortion. Next be sure that your 12AX7 is not overdriven. Some mikes have enough output to overload the speech stage. I suggest that a gain control be added to the DX-40. Those of you who want the diagram for adding such a control drop a line to HAM CLINIC.

Above all, make certain that your DX-40 is loaded properly. If it is not you will have some distortion. Remember that the screen modulation system needs *heavy* loading, for its Z characteristics changes enough as it is. If you have a DX-40 received previous to 12-3-58, place a .001 mf condenser from pin #9 (6DE7) to the nearest ground point. If the set was received after 12-3-58, place a solder lug beneath the retaining nut of the machine screw holding the 12AX7 tube socket in place and solder an additional connection from pin #9 (12AX7) to the solder lug. If you have bassy response try substituting coupling condensers of approximately

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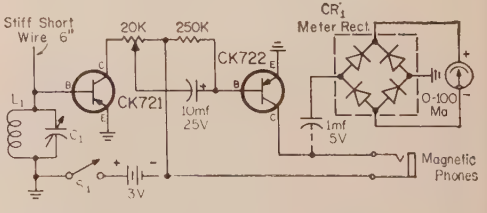

Fig. 2—Schematic diagram of a transistorized mobile modulation monitor for use with phones. With the addition of the metering circuit shown capacitively coupled to the phone jack, a meter indication may be obtained.

Novice

by DONALD L. STONER, W6TNS
P.O. Box 137, Ontario, Calif

Although not particularly concerned with Novice operation, for your general knowledge, you should understand how various types of mobile (battery operated) power supplies operate.

Vibrator Supplies

This type of supply is used to obtain a high d.c. voltage from a comparatively low d.c. source. A vibrator power supply is much more efficient than a dynamotor and is used extensively. A simple vibrator power supply is illustrated in Fig. 1. It is nothing more than a simple interrupter similar in many respects to a buzzer. The pulsating d.c. is used to energize

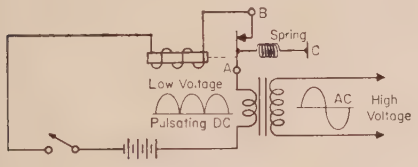

Fig. 1—This simple circuit illustrates the principle of the vibrator power supply, but is very inefficient.

the primary winding of a transformer, which in turn induces an a.c. voltage in the secondary. The turns ratio of the transformer windings are proportioned to give the desired output voltage. Referring to Fig. 1, when the switch is closed, current will flow through the primary of the transformer, through the electromagnet, and then back to the battery. In passing through the electromagnet it will set up a magnetic field drawing the armature A over to it. This action breaks the circuit at B. As soon as the circuit is broken, the electromagnet will no longer attract the armature, thus allowing spring C to pull it back to the original position. At the starting position, contact B again closes and the process is repeated. In this way there flows through the primary of the transformer a pulsating direct current which induces a high voltage in the secondary winding. The output voltage of the secondary is applied to a conventional rectifier and filler network which changes the alternating current back to direct current, but at a new and higher voltage.

A more complete circuit diagram of a typical vibrator power supply is shown in Fig. 2. A better waveform in the output voltage is obtained in this circuit by the use of the center-tapped primary transformer. When the primary circuit is closed, the vibrating reed D is drawn

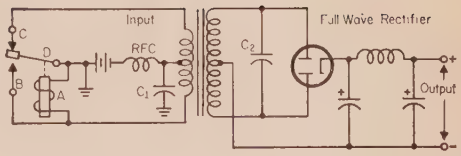

Fig. 2—This vibrator supply is often used in low power equipment, such as automobile radios and QRP transmitters.

down by electromagnet A until it closes contact B. When this contact closes, a pulse of current flows through the lower half of the primary winding of the transformer. At the same time the electromagnet is shorted out by contact B, and loses its attraction for the vibrating reed, thus allowing it to spring back and make contact at C. This contact completes the primary circuit through the upper half of the primary winding and another pulse of current flows. As soon as the reed breaks the connection at B the current from the battery again can flow through the electromagnet. The electromagnet then pulls the reed down once again, repeating the entire process. Voltage which appears across the secondary will be truly alternating. Capacitor C_2 smoothes out the surges of current. In order to prevent r.f. interference caused by sparking at the points B and C, filter choke RFC and capacitor C_1 are placed in the circuit. The entire unit is placed in a metal can to shield nearby sets from any interference caused by the vibrator.

Dynamotors

A dynamotor is used to change a low d.c. voltage to a high d.c. voltage to supply plate power for receivers and transmitters. It is essentially a motor and a generator mounted, or wound, on a common frame. A single field winding is used to provide the magnetic field for both the driving and generating purposes. The armature consists of two windings, both of which are wound on the same armature core, but connected to separate commutators. One winding serves to produce the driving force when energized by a low d.c. voltage. The other winding serves to produce the high voltage when rotated within the magnetic field.

Filters are placed in the high-voltage leads to filter out high-frequency currents produced by sparking between the brushes and the commutator segments, so that it does not cause interference to radio reception. The filter consists of

a combination of r.f. chokes and capacitors. The purpose of the chokes is to prevent circulation of the r.f. energy through the external wiring. The capacitors serve to "short" this energy to ground. Some additional filtering must also be provided to eliminate commutator ripple. This will usually consist of a series inductor of comparatively high value and a shunt capacitor. Functional characteristics of the filter are similar to filter action discussed several months ago.

The circuit diagram of a typical dynamotor power supply is shown in Fig. 3 choke L_1 is an

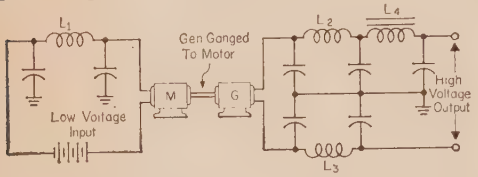

Fig. 3—The dynamotor uses rotating machinery to convert low voltage d.c. to high voltage d.c.

r.f. unit to eliminate any r.f. energy in the low-voltage circuit. M is the motor section of the dynamotor and is connected to the battery, which provides the driving power. G is the generator side of the dynamotor and the output from this unit is fed through the choke coils L_2, L_3, and L_4. Chokes L_2 and L_3 are r.f. choke coils, choke L_4 is an iron-core coil. In combination with the capacitors across the line, these chokes serve to prevent radiation of r.f. energy and to reduce commutator ripple in the output voltage.

Transistor Power Converters

Transistor power converters have all but replaced the vibrator power supply and dynamotor because of their high efficiency (75 to 94%) and the fact that they are instant starting and have no moving parts.

The circuit for a typical supply is shown in Fig. 4. You will no doubt note a similarity to the vibrator circuit of Fig. 2. However, transis-

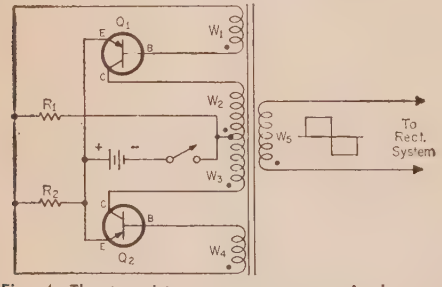

Fig. 4—The transistor power converter is the most efficient device for converting a low d.c. voltage to high voltage. There is no limit to the amount of power that can be handled, with suitable transformers and transistors.

tors have replaced the vibrating reed in a circuit called a *magnetically coupled multivibrator*. The battery voltage and the transformer primary winding determine the free running frequency (corresponds to the reed frequency in the vibrator). The action of the circuit is as follows: When switch S^1 is closed, one transistor will conduct more because of inherent dissimilarities. For the purpose of explanation, assume that Q_1 draws the greatest current. Current flows from the negative terminal of the battery up through W_2 and returns to the battery via the collector and emitter of Q_1. This in turn induces an opposite voltage in W_1 of the correct polarity to make the transistor draw more current. Almost instantly the transistor and the core are in a state of *saturation* (in other words, the transistor can pass no greater amount of current and maximum flux density occurs in the transformer). Since the lines of force are no longer moving, no voltage is induced in W_1 and the current through Q_1 starts to decrease. The decreasing current in W_2 induces an opposite current in W_4, causing Q_2 to increase conduction. As before, the increased current in W_3 causes Q_2 to draw even more current because of the induced voltage in W_4. This transistor instantly saturates, causing maximum current to flow in W_3. This action repeats at a very high speed as long as S_1 is closed.

The transistors can switch many times faster than a vibrator which usually operates at a frequency of 120 cycles, while transistors work nicely at one to five kilocycles. Thus, only 2 mf (or so) of filtering is required compared to the 20 to 40 mf usually encountered in a vibrator supply.

The transistors can handle a load current many times their dissipation because of the fast switching time. Heat in the transistor is the determining factor. Heat is only generated during the transition from the conducting to non-conducting state and the transistors get a rest during alterations.

New Equipment

The Heath DX-60, successor to the famous DX-40, has many features of interest to the Novice operator. New features include a built-in low pass filter for harmonic suppression, a

neutralized final for high stability, grid block keying for improved keying characteristics and easy access to crystal sockets on the rear chassis apron. A front panel switch selects any of four crystal positions or an external v.f.o. Modulator and power supply are built in and single knob band-switching with pi-network provide complete operating convenience. A tune-operate switch protects the transmitter during tune up and a separate drive control allows adjustment of the drive level without detuning the driver.

The DX-60 can be used for Novice c.w. operation with reduced input power, although it is capable of a full 90 watts input. It appears to be an excellent buy at $82.95.

Novel Power Supply

Speaking of power supplies, as we have been doing for the past few months, I ran across a novel power supply circuit that advanced Novices might like to duplicate. A special multiple winding transformer is used in either a bridge or full-wave rectifier circuit. In the full wave position, the h.v. output will be approximately 400 volts at 200 ma. By flipping the switch to the bridge position, the half-bridge output connection supplies the 400 volts, while 800 volts is available at the h.v. connection. Three taps on the high voltage secondary winding permit adjustment of the exact output voltage to compensate for line variations. In addition to the rectified d.c., you can obtain the following filament voltages: 5 volts at 6 amps, 6 volts at 12 amperes or 12 volts at 6 amperes. This should be an extremely handy power supply to have around the shop for testing or even compact home-brew transmitting equipment. The 5U4GB is a common television tube, but the 6BL4 is usually used in color television receivers and may not be readily available. Check with your local distributor. The remaining components, with the possible exception of the power transformer (A Thordarson 26R00), are available directly from dealer stock.

[*Continued on page 110*]

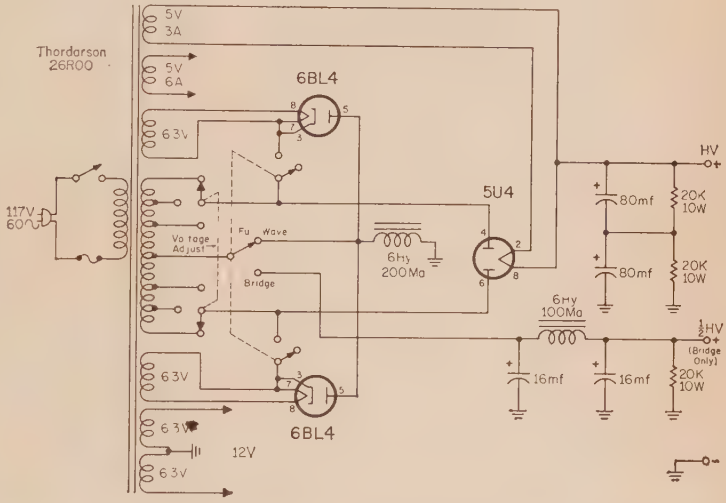

Fig. 5—Schematic diagram for the novel combination bridge and full-wave power supply. Although no specific construction information is given, advanced Novices should have no trouble duplicating it.

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Noteworthy Novice

Mike Meenan, WV2QEM, The Choate School, Wallingford, Connecticut, is a real newcomer to the Novice ranks, having held those call letters for only 3 weeks. Mike sounds like a real go-getter and is the guiding genius behind the school station, W1YEY. The radio club consists of Mike, Pete Rosden, K3NDH and two prospective Novices awaiting their tickets. Between studies Mike fires up the Viking II on 15 meters, his favorite band (look for him crystal controlled on 21.12). The club still needs Utah and W. Virginia for their WAS.

Shake QSL's with Bill Mullin, KN4ZVS, of Alexandria, Va. In addition to all his accomplishments mentioned in the column, Bill has his Rag Chewers Club certificate and a code proficiency for 15 words-per-minute! We'll look for you to shed the "N" soon, Bill.

Mike likes to do a bit of DX chasing and the club has collected contacts with 9Q5 (Congo), FF7, KZ5, KV4, LU6, WL7 and a VE6.

Mike says there were doomed forever to use the DX-35, due to the poor condition of the Viking, until his friend Chris, K1LZE, came to the rescue and patched it up. The Viking now gets FB reports on phone and c.w., but unfortunately they also get T9 reports on the school PA and hi-fi systems!! Mike says "our schoolmates are outside throwing two nooses over a tree limb! Fabian and CQ DX do not mix—hi."

Let's hope it all turns out well, Mike, and we'll be looking for you on 15 c.w. ■

VHF

BOB BROWN, K2ZSQ
67 RUSSELL AVENUE
RAHWAY, NEW JERSEY

50mc. 144mc. 220mc. 420mc. and above

KH6UK—W6NLZ

The big news this month is, of course, the winners of the Edison Radio Amateur Award sponsored by General Electric, John T. Chambers, W6NLZ, of Palos Verdes Estates, California, and Ralph E. "Tommy" Thomas, KH6UK, of Kahuku, Oahu, Hawaii. I'm sure we'll all agree that it went to two well-deserving members of the v.h.f. fraternity, and most rightly so for their efforts in completing a 2,540 mile course between Hawaii and California first on 144 mc in July, 1957, next on 220 mc in June, 1959, and the latest record on 432 mc on July 20, 1960! Ever since this famous pair teamed up years ago, we've all been avidly following their work on v.h.f.—u.h.f. with much interest and excitement. Our sincere congratulations to KH6UK and W6NLZ!

Propagation

Over the past few months, many letters have been received from readers interested in learning more about propagation and its effects on v.h.f.—u.h.f. work. Our pet project, the Sporadic E mapping system has netted many enthusiastic v.h.f. men interested in helping us to learn more about this one phase of propagation. But before we go off the deep end into a discussion of various technical aspects of Sporadic E or any other mode of propagation, we should try to lay some "groundwork" for basic understanding of the more fundamental conditions that exist in the atmosphere affecting our v.h.f. interests. Each month we will try to outline some form of propagation in this column to help you understand the "how" and "why" of band conditions. I make no claims to be a propagational expert, but I would rather act through this column as a medium or place where ideas can be gathered and presented for the consideration of fellow v.h.f. men. In any technical discussion one must start from the bottom and work up. This brings us down to the first concern of v.h.f. men regarding propagation, the troposphere.

Robert Morrison, K2RRG, has written the best analysis on this subject I've seen in a long time. Therefore we'd like to turn the topic over to him. The following material written by Bob appeared in a recent issue of *The VHF Amateur*...

"Before we discuss any one type of propagation, we should know where all the various forms of propagation take place. All propagation, as we know it, takes place in the earth's atmosphere. This relatively thin layer extends from the earth's surface out (or up) approximately 300 miles. But to say that Sporadic E skip takes place in the earth's atmosphere would be like saying New York is located in North America. Next, we must break down the earth's atmosphere.

"Starting from the earth's surface upward to a height of six miles we have the *troposphere*. The next layer after leaving the troposphere is known as the *stratosphere*. This region extends upward from the troposphere about 30 miles. We have now broken down the earth's atmosphere into two regions accounting for approximately forty miles of the 300 mile layer. The remaining region above the stratosphere extending to the edge of the earth's atmosphere is the *ionosphere*. Generally speaking, all v.h.f. contacts of over 800 miles are the result of propagation found in the ionosphere. It accounts for Sporadic E, F2, aurora, and the various types of scatter. I believe in starting at the bottom and working up. So let's begin with the earth's atmosphere we live in.

Troposphere

"This area, as stated earlier, extends upward from the earth's surface about six miles. All of our weather—snow, rain, wind, etc., is formed in the troposphere. For this reason, it is sometimes referred to as the 'weather layer.' The troposphere is of prime importance to the v.h.f. man in that it is where our ground wave takes place. Ground wave, like the weather, is subject to change without notice because the condition of ground wave is solely determined by the weather.

"Even in the most elementary discussions of propagation, it is important to use the correct terminology. The term 'ground wave' is commonly used in referring to contacts made in the absence of skip propagation. We now know that the condition of the v.h.f. bands as far as ground coverage is concerned is determined by the weather.

"Have you wondered why one day ground wave signals are very strong and twenty four

hours later, these same signals are down in the mud? The path between stations hasn't changed, but what *has* changed is the weather. This is not to say the change was such to be noticed at ground level or as obvious as a change from hot to cold. This change in tropospheric conditions is known as a temperature inversion.

"There are many types and as many causes of temperature inversions. Perhaps, a general explanation of the causes and results would help the v.h.f. operator to anticipate and thus capitalize on this phenomenon.

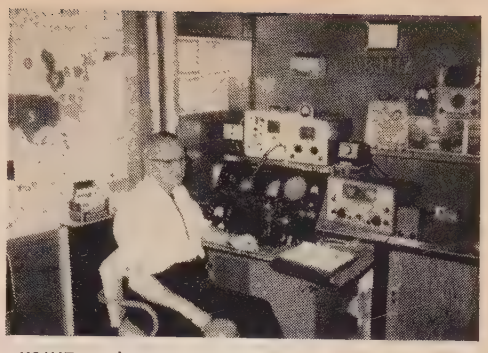
"A text book definition of a temperature inversion: 'When masses of air become stratified into regious having differing dielectric constants.' While this statement is absolutely true, perhaps after reading it, a newcomer making an honest effort to learn about propagation would be confused, or, worse yet, discouraged. What we are trying to understand is why under certain conditions our ground wave coverage is extended beyond its normal range.

"A temperature inversion as earlier mentioned is the cause. The proper term used to describe the result would be 'tropospheric refraction' or 'tropo bending.' Using proper terminology here is important in that it, in part, tends to define as well as describe this phenomenon.

"After leaving the antenna, v.h.f. radio waves travel at an angle up through the earth's atmosphere and on into outer space. This is the normal path v.h.f. signals would continue to follow if it were not for propagation. Much like a switch yard reroutes freight cars, various forms of propagation found in the earth's atmosphere reroutes v.h.f. signals.

"A typical example of a temperature inversion would be if during a hot spell, a cool front were to move in. This cool air mass moves in and is positioned below a hot air mass. Now we have two layers of air, the lower air mass being cooler is the denser of the two. When the v.h.f. signal enters the cool air mass (at an angle), its speed is reduced due to the density of the layer. The radio waves traveling at an angle other than 90° will not leave the cool air mass in one part nor will they enter the less dense hot air mass in one part. The first part of the radio wave to enter the less dense hot air mass is speeded up causing it to get ahead of the other sections of the wave that will follow later. This sort of pivot action changes the direction in which the radio waves are moving. Instead of continuing off into space they are bent back to earth. The extent of this bending is determined by the relative density of the air masses. When the boundary of a temperature inversion is sharply defined, radio waves traveling at low angles of elevation are trapped by the refracting layer of air and will continue to be bent back toward the earth.

"Radio waves trapped in such a way will follow a *duct* formed by the boundary layer and the earth's surface. If your antenna is in this *tropo duct*, ground wave contacts for several hundred miles are possible.



K8JHZ at the operating position. He is a member of the Greater Cleveland VHF Club.

"Temperature inversions are more likely to occur during the warmer months of the year. But look for super inversions during the early summer and early fall when slow moving high pressure fronts (cool air) traveling west to east, are met by warm humid masses moving north from the Gulf of Mexico. Stationary fronts can be formed causing sharp inversions lasting a few days at a time.

"Perhaps, now that you have a general picture of a temperature inversion, you can better understand why ground wave is best early in the morning and again after sunset. Remember, we need two air masses of unlike density in order that the speed of a radio wave be changed. The unlike air masses create our temperature inversion and the radio waves by changing speed result in *tropo bending*. At sunrise the upper air is the first to be heated by the sun's rays, while the lower air nearer to the surface of the earth is still cool by the effects of night. After sunset the reverse is true; without the heat of the sun, the earth cools rapidly in turn cooling the lower atmosphere. Both are forms of temperature inversions resulting in tropo bending.

"When discussing v.h.f. ground wave, it would be fair to say that it is the toughest way of getting out. To illustrate this, how many QSL cards do you have confirming skip contacts over one thousand miles away? Now count your ground wave QSL's from stations a mere hundred miles or more away. The ionosphere helped get your signal out to the West Coast. By contrast, to get a good signal to the next state, you've got to help the troposphere. The station set up to get the best ground wave coverage as possible will also be best prepared for skip. Three factors determining effective v.h.f. communications are *antenna system, station equipment, and operating skill*. The latter is a subject in itself which we hope to cover later. But bear in mind that the skillful operator has the ability to anticipate various conditions. The station equipment for effectively working ground wave should consist of a transmitter of at least medium power capable of A1 and A3 emission. The receiver and converter—the best your means will allow. As for your antenna system,

think long and hard before putting up something that may end up being a weak link in an otherwise strong chain. Only by improving the antenna system can your ground wave coverage be extended, both in your ability to receive as well as get out. First you must hear the signals. Many hams stack their v.h.f. antennas without knowing why. True, by doubling the size of the antenna we can realize a gain of 3 db (if stacked correctly). But just as important, if not more so, by stacking correctly the antenna we've lowered the angle of radiation. In ground wave work, the lower the angle of radiation, the better."

Left to right: Corliss Howard, K3MUR, Earl Foster, W3BKF, Alan Mathews, W3BEF, and Lyle Williams, K3ABC, at the Big "K" A. R. A. clubhouse during the "Santa Claus" broadcasts of 1960.

Antennas

I think we'll all agree that Bob's remarks on the antenna system truly represent most of our ideas. But the fact remains that few v.h.f. men actually practice this theory. Most are more concerned with modulation quality, converter peaking, etc. These are important, definitely so . . . but we must consider *balance*. For a ham to get the most out of his station, for making the most of propagation phenomena, and in general getting the most out of v.h.f., his station equipment and antenna system must maintain a clear-cut balance. Time and time again I've run across 500 watt and KW stations who just can't hear the others answering him due to poor receiver/converter conditions in his equipment. Also, the converse is true—those who spend all their time and money into getting top-performance converters and expensive receivers without being able to be heard by the stations he hears calling "CQ." The ultimate goal in station equipment selection should be to maintain a balance in the equipment. *Then*, and only then can we appreciate fully the advantages of a good antenna system.

Once proper balance is achieved, the antenna can make all the difference in the world. We hear all the time of the pros and cons of Yagis vs. stacked arrays, parabola vs. long johns, etc., but regardless of what you select, your antenna will be the only means of extending both your receiving *and* transmitting capabilities. All of us have our own personal preferences along these lines, and this is as it should be—in the true ham spirit, but remember that your antenna will make the difference between getting "out-of-town" and reaching two to three hundred miles under normal conditions.

As mentioned earlier, we hope to be able to present regularly features on various forms of propagation. We hope this will help you toward a better understanding of these ever-present phenomena. But without a well balanced receiver/transmitter relationship, and, most of all, a good antenna setup, you won't be able to fully utililate the capabilities you and your station possess. An efficient station will help you immensely in *all* your propagational endeavors.

Operating Skill

Here is another topic that is all too commonly ignored. Whether your v.h.f. interests lie in local rag-chewing, DXing, or both, operating skill is a major determining factor in whether or not you get the ultimate out of your capabilities. We are all familiar with the necessity of good operational procedure on CD nets, AREC, and traffic nets, but do we fully realize the importance of individual operator skill in our day-by-day contacts?

There are so many facets of this topic that it would be impossible to discuss all of them here, without enlarging this column another 5 pages. What we would much rather do is print letters along these lines from you, as observers on the v.h.f. bands toward a goal of improving and furthering individual operating procedures and general know-how. May we hear from you?

Let us take, for instance, the v.h.f. man interested in furthering his "working radius" or possibilities of better and more DX. He will learn or has already learned that careful listening and studying of propagation is the only way he will succeed. The operator who learns to listen before he throws that "transmit" switch is the one who will snag the rare ones. Careful listening for weak signals on the band will prove more than a quick tune of the spectrum and a listen for the locals. By concentrating your efforts on signals 80-100 miles away you will learn when, where, and how to get these distant stations. The DX records broken or made over the years have *not* been with "armchair copy" and S9 signals, but by constant digging into the noise for the weak stations.

After a time you will probably find a great enthusiasm and intrigue in hearing and working stations the local boys don't hear. You'll find, however, that they *could* hear them if they listened for them. This is where operating skill makes the difference. I've visited many shacks much better equipped than most, and I'm constantly amazed by such remarks as, "Why can't I work DX, when I've got a much better QTH than Charlie?" Careful tuning of his receiver brings the startling fact that he *can* actually hear Charlie's DX stations an S unit or more stronger, but he tends to tune right over them in search of a more copyable signal.

Again, this is only one small part of what can be termed "operating skill." What have you found that helps you to develop your ability to work distant stations? We'd like to hear to what you attribute your success. Why not share your knowledge with the fraternity?

Zephyr VHF Society

The Zephyr VHF Society, Inc., was instituted in January 1961, when six amateurs active on two meters met in Oakland, N. J. and elected WA2EKM President, K2LNO Vice President, WA2DPN Treasurer, and K2RAO secretary. Technical Director and Net Manager is W2HUX and the Director-at-Large and trustee is WA2HCI.

Total membership is limited to fifteen and the group is drawing plans for contests and Field Day at their site at Oakland which boasts an elevation of 1150 feet. Along with net meetings on-the-air Wednesdays at 2100, the society will handle traffic and participate in emergency and disaster control in the communications field with portable, mobile and fixed location equipment.

The Society lists a spring exercise in May and *CQ* will keep you informed of their activities.

Hamfests and Conventions

May 26-29: The Southwestern Division ARRL Convention will be held at the Westward Ho Hotel in Phoenix, Arizona. This has a lot to offer the v.h.f. man this year with booths, talks, and just about everything conceivable. Pre-registration costs $8.50 and the registration at the door is is $10.00. Both of which include an elegant banquet in the Thunderbird Room of the hotel and a breakfast of your choice. Prizes?—Galore! Write to 1961 SW ARRL Deal, P.O. Box 7155, Phoenix, Arizona.

May 28: The Seventh Annual Hamfest of the Breezeshooters will be held on Sunday from 9 AM to 6 PM at The Lodge, North Park, near Pittsburgh, Pennsylvania. North Park is easily accessable from the Pennsylvania Turnpike. Picnic facilities and refreshments are available, mobile check-in will be on either 29.36 or 50.4 mc. There will be about 1000 hams present, so come and meet your friends. For further information, contact Dan Davies, W3OPF, Box 226, Silver Lane R.D. #1, McKees Rocks, Pennsylvania.

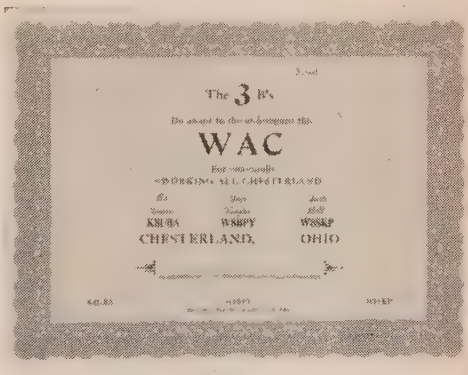
June 18, 1961: The 7th Annual Picnic of the Royal Order of Hootowls (a six meter radio society) will be held at Gaffneys Lake Wilderness Resort near Seattle, Washington Registration is 50¢ per R.O.H.O. member and $2.00 for non-member. This includes prize registration with family included free. Potluck dinner will be served by the food committee at 1 PM sharp. Contests galore! Write to Lee M. Singleterry, W7YJE, 1914 Gallinger Road, Seattle 55, Washington, for further details.

July 22, 23: The 27th Annual Glacier Waterton International Peace Park Hamfest. We'll have more details later. Meanwhile, write to Bob Henry, VE6DB, 1138-24th Street South, Lethbridge, Alberta, Canada.

Certificates

Greater Cleveland VHF Club: This group was kind enough to send me a certificate issued by their fine club. K8JHZ informs us, "To belong in this club you must be interested in v.h.f., and they must send me a list of members worked (six worked on six). For those outside U.S., only one contact necessary." Art's QTH is 28917 Westwood Road, Bay Village 40, Ohio. Might mention that the Greater Cleveland VHF Club has remained over the years as the stalwart of v.h.f. clubs anywhere, and is by far one of the most highly regarded in the nation. If you can at all work 6 stations to become a member, by all means do so! It is a real privilege to be associated with such a fine group!

Working All Chesterland: Here's a real novelty that's the brainchild of K8UBA, W8SKP, and W8BPY. To get this certificate you must work all three B's, Ed Bastin, Jack Ball, and Jack Bayha. For further information write to Jack Bayha, W8BPY, P.O. Box 34, Chesterland, Ohio.



W3FEY—Opinions on 432

George, W3FEY, (858 Eden Road, Lancaster, Pennsylvania) writes us re 432 . . .

"I was a bit surprised to see the comments favoring giving up part of the 432 mc band in

exchange for 1 KW in the remainder. I believe this is a very short-sided view of the situation. Under no circumstances can we afford to relinquish any part of the 420-450 mc band. The fellows suggesting this change should give some thoughts to the future requirements of amateur communication in the u.h.f. region. It's true that the 420-450 mc band is far from crowded now, but we must remember that the h.f. bands have essentially reached the point of saturation and for a new station to squeeze in, somebody else gets pushed off (or you add another to the round table, etc.). Our v.h.f. bands are being occupied very rapidly and the push to go higher is inevitable. The 420-450 mc band is probably the ideal band for amateur moonbounce communications when we get high power. Obviously this will bring a flood of new stations to the band because 432 mc gear is within the capability of many more hams than 1296.

"The needs of ham TV must not be forgotten in our eagerness to better the lot of the communications men. TV is of necessity a wideband service and let's remember that most hams will probably go double sideband which means a 8-10 mc bandwidth for each station. That's three TV QSO's and a niche for the communication men in the entire 420-450 mc band. Really we ought to ask for expansion of the band, not a decrease.

"I am strongly in favor of high power on the 420-450 mc band. Somehow we must get it. For really effective space communications work 10 KW would be nice but I suppose we'll have to be happy to get 1 KW. In all the time I've spent on 432 mc I have never heard a non-ham signal that was legally on the band. I'm referring to a TV receiver radiation of course.

"If we want another crusade let's go after auto ignition and TV receiver radiation interference. Something will have to be done eventually—Why not now?"

New Equipment

Clegg Laboratories, of Rt. 53, Mt. Tabor, New Jersey, headed by W2LOY, has just announced their new Climaster *Zeus* transmitter for 2 and 6 meters. This unique rig runs 175 watts input on A.M.-C.W. on both bands with a self-contained v.f.o. It is a two unit deal with remote modulator and power supply which conserves space at the operating position. It utilizes high level plate and screen modulation with automatic modulation control which "outperforms even many kilowatt rigs."

It is guaranteed to outperform any other commercially available transmitter for v.h.f.! Amateur net price is $559, completely wired and tested with all tubes, modulator, power supply, v.f.o., cables, etc. The Climaster *Zeus* truly represents the ultimate in v.h.f. transmitters.

V.H.F. Man of the Month

This month, in accordance with General Electric, we present Ralph E. Thomas, KH6UK, as a truly outstanding v.h.f.-u.h.f. enthusiast. "Tommy," as he is called by his friends, is well known to just about every v.h.f. man in the country, and, for that matter, anywhere in the world. "Tommy" is engineer-in-charge of an RCA communications transmitting station in Hawaii and has long been interested in conducting experiments with W6NLZ in a radio phenomenon known as "tropospheric ducting." Using home-made and surplus Army material, great advances have been made in recent years due to his efforts.

To quote General Electric, in the issuance of the Edison Award, "The feat was recognized by contest judges as being compared to the first trans-Atlantic communication early in the 1920's. Federal Communications Commissioner Rosel Hyde, one of the judges, pointed out that technical achievements such as this (2,540 miles on 432, 220 and 144 mc) constitute a principal reason for the government's encouragement of amateur radio."

Mailbag

Stonington, Connecticut: Help requested from Dick Johnston, K1QJD, ex-K7NMA, ex-W4DLY . . .

"I have recently returned from Cheyenne, Wyoming, where I spent nine months enjoying the sport of being DX on 6 and 2 meters.

"Now I have taken up residence here in Connecticut, and desire to go higher. Understand that there is some activity on 1215 mc. Do you know where I can purchase several APX-6s? There are several hams in the area that would like to rework these units. Either New York or Boston would be fine." *I've received many letters from others requesting info on the APX-6s, but can't get any dope myself? Can anyone help? Dick's address is R.F.D. #1, Rural Box AR No. 51, Stonington, Connecticut.*

Bossin City, Louisiana: This one's from Eddy Shell, W5ZBC . . .

"Would like to give your readers a report from Louisiana (Shreveport-Bossier City area). There are a few very active hams here: W5ARL, K5VM, and W5ZBC. The local frequency is 50.460 mc, however we can sometimes be found around 50.170 mc. To give a run-down of equipment here, W5ARL—17 watts; K5VMC—40 watts, and W5ZBC—3 watts. We all use four elements. We have had a few band openings in the past three months.

"I have worked Indiana, Colorado, Florida, Texas, and North Carolina, with a Heath Sixer. The XYL came through with an International converter for six which is waiting for the next band opening. Wish the Texans would tune 50.460 mc each night. Hear them on 50.4 mc but unable to break in." *Well, keep trying, Eddy, and many thanks for your interesting report. Keep 'em coming!*

Decatur, Georgia: Bob Harrell, K4OLQ/W4RHL, writes . . .

"Just thought I'd drop you a line and say that I am getting ready to fire up on 50 mc. My receiver is an S53A and my transmitter which I am still working on, is a modification of the rig in the October *CQ*. I plan to run it at about 10 watts on c.w. I have a crystal available for 50.640 mc but I do intend to move below 50.1 mc for c.w.

Brookline, Massachusetts: Dick Marshall, K1KTK, Century Club Award winner #1010, writes . . .

"A little information on what we're doing here in Eastern Massachusetts. Three of us, W1JSM, K1JBL, and me, are converting APX-6s and plan to be on 1215 mc very soon." *Where did you get them?!—ED.* "I'll keep you informed of our progress.

"I am presently on 6 and 2 meters. The six meter gear is a homebrew 815 final running 60 watts input and a 4 element Telrex beam. The two meter gear is a homebrew 6146 final running 60 watts input and a Telrex 8 over 8 stacked array. The receiver is a HQ-110 with a Tapetone converter for two. The beams are up about 85 feet. The XYL is K1NGI." *Many thanks for the report, Dick, and congratulations on your CCC!*

Duarte, California: Fred Handy, WA6JOV, writes . . .

"Using an HQ-110, Gonset Communicator III, Seneca and 10 element beam 40 feet high.

"I usually monitor the 6 meter band at 7:15 to 7:45 and 12:00 to 12:30 as well as 1630 to 2200 every weekday. On the weekends the receiver is on constantly so if there is any activity on, I will hear it.

"There are stations to the south of me with better antennas but I can only hear one side of the QSO due to directionality." *Many thanks for your letter, Fred, and will enter you on our Sporadic E Mapping System list which will be underway soon.*

Hammondsport, New York: Walter "Falcon" Taylor, K2MLT, writes . . .

"I'm enclosing several photos of my new radio station on 1900 foot mountain, ½ mile in back of my home. This project has taken months of hard work to reach the present stage of completion. The farthest main transformer is almost 2,000 feet away which meant installing my own telephone and electric poles for 220 as well as 110 volt service.

"There will be four No. 5 Rohn towers with a maximum height to the rotor of 70 ft. approximately. You will notice two are in position with two more to go.

"The antennas on the finished ones are two 8 element 6 meter antennas, stacked 12 ft. apart and four 2 meter 10 element 12 ft. boom yagis, stacked 11 feet apart on a special homemade Lazy H and stacking harness. These towers are mounted in blocks of concrete which have special hinged bases, also homemade. In order to pull these towers with antennas onto an upright position, I use a Jeep Station Wagon with a heaving winch to raise and lower them for adjustment.

Here's a shot of K2MLT's antenna problems in milder weather. The building is Walt's shack. Imagine! A real ham shack!

"I have a standing wave ratio of 1:1.2 on both 50 and 144 mc. The other towers are for 220 and 432 mc. These will not be installed until Fall.

"The radio shack is home constructed and is quite large with four operating positions, insulated and electrically heated. The long walk keeps me in shape and makes me appreciate my hobby much more.

"I have a Johnson Thunderbolt 6N2 ready to answer any callers. Rae, VE3BPR, 150 miles away from here, and I have skeds 3 times a week. He is directly north from me and has a strong phone signal here always. We operate on 144.09 and 145.08 mc.

"Keep up the good work you are doing for Ham Radio. Anyone for skeds, please drop me a line." *Wow! Really sounds like your going to town, Walt! Be listening for you. Keep us informed and don't forget some pictures inside your new shack!*

Thirty

Incidentally, this issue will carry an announcement of a brand new book entitled *"VHF For The Amateur"* by Frank C. Jones, W6AJF. The latest edition to the Cowan Library, this is one of the finest volumes ever published on the subject, and is chock full of fine construction projects as well as excellent theory and general information.

The author, one of the best known v.h.f. men in the world, has spared no effort toward making this volume the ultimate in v.h.f. coverage. His smooth style will be well received by all v.h.f. enthusiasts from the old-time experimenter to the brand new novice or technician just cutting his first ham teeth. Don't Miss out on your copy.

Well, that just about wraps it up for another month. Let's hear from you next month. Remember: We're having another contest in a few months and I'd like to hear from you with your suggestions.

73, Bob, K2ZSQ

RTTY

Byron H. Kretzman, KØWMR
108 W. Teresa Drive
West St. Paul 18, Minn.

First Two-Way RTTY QSO on 1215 Mc!!!

What is believed to be the first two-way RTTY contact on 1215 mc was accomplished on February 11, 1961 at 0805 GMT when W6TPJ of Rosemead, Calif., made a solid 30 minute RTTY QSO with W6CG of Temple City. W6TPJ followed this by a second contact with K6OWQ also in Temple City. The equipment used at both ends of this QSO was APX-6/1FF jobs converted by W6TPJ for use on the 1215 mc bands, and the antennas were of the corner-reflector type. AFSK and F-2 emission was used for the RTTY transmissions.

Following is a tape of the first transmissions made during the above mentioned QSO:

W6CG W6CG DE W6TPJ W6TPJ IN ROSEMEAD CALIFORNIA TESTING AND IN QSO ON THE 1215 MC BAND PROBABLY THE FIRST 1215 MC RTTY QSO. YOUR SIGNALS ARE 559 BUD AND WONDER IF YOU ARE ABLE TO PRINT ME THERE? W6CG W6CG DE W6TPJ W6TPJ ROSEMEAD CALIFORNIA ON FEB. 11 1961 AT ØØØ5 PST. AR AR K K K
W6TPJ W6TPJ ROSEMEAD CALIF DE W6CG W6CG TEMPLE CITY CALIF CONGRATS JERRY UR SIGS 579 SOLID PRINT HERE FOR WHAT I HOPE IS THE FIRST RTTY QSO ON 1215 MC.

When the Twin City TU (radioteletype converter), described in last month's RTTY column, is used on the h.f. bands where it is required to battle QRM, a band-pass input filter is almost a necessity. The reason for this is that the limiter preceding the discriminator is a very good harmonic generator. For example, when the receiver b.f.o. is producing the standard RTTY tones of 2125 and 2975 cycles, a very strong unwanted beat note of about 1500 cycles will produce, in the limiter, a response around 3000 cycles (the second harmonic), thereby QRMing the 2975 cycle space tone that we are attempting to use. The solution: knock down the amplitude of the unwanted 1500 cycle tone, *before* it gets to the limiter.

A Band-Pass Input Filter

Figure 1 shows the schematic diagram of a simple but extremely effective band-pass input filter. This was originally conceived by Phil Catona, W2JAV, and was first published in this column back in the January 1956 issue of *CQ*. Our only addition is to add a 3 db T-pad to provide some measure of isolation between the receiver and the filter to minimize any possible effect of the reactive component in the audio output transformer of the receiver with which the TU is used, thereby assuring satisfactory input filter performance. The numbers in the circles indicate the pin connections in the octal plug of the filter assembly. These numbers correspond to the input and output (and ground) socket pin numbers on the ACCESSORY socket of the Twin City TU.

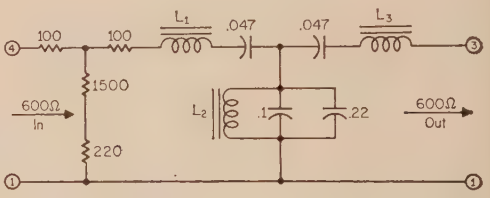


Fig. 1—Band-pass input filter for the Twin City TU.

The two inductors, L_1 and L_3, are the ubiquitous 88 mh telephone loading coils, each with both windings connected series-aiding, exactly as previously described for the channel filters in the Twin City TU. The Inductor L_2 is made from another of the 88 mh toroids by unwinding 14 feet of wire from one winding. The other winding is not used. Make sure that there is no connection or short on the unused winding. The capacitors used happened (that was what was in the junk box) to be mostly Sprague "Vitamin-Q," which are paper, but hermetically sealed. Mylar capacitors would be the best, if you insist. *Do not use ceramic capacitors.* The resistors are all of the ordinary ½ watt variety with a 10% tolerance. All of these parts are assembled on a 3⅝" by 1¼" bakelite board about 3/32" thick. The board is fastened to the octal plug-in base of a Millen #74400 shield can and plug base assembly by means of small metal angles screwed to the square brass posts provided for fastening the aluminum shield can. Make sure, too, that one of the posts is grounded to pin 1; and, that the input to the T-pad is connected to pin 4 and that the output goes to pin 3.

A variable frequency audio oscillator and an a.c. vacuum tube voltmeter, such as the Heathkit AV-3, can be used to quickly check the performance of the filter. A 600 ohm dummy load, consisting of a 330 ohm resistor in series with a 270 ohm resistor, was connected to the output terminals and the VTVM was connected across the load. The frequency response will look some-

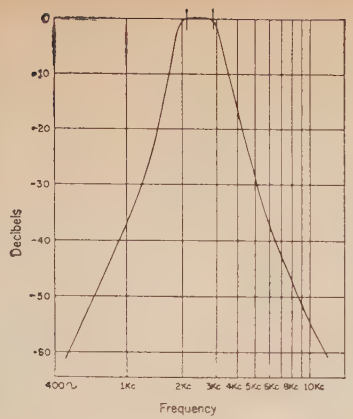


Fig. 2—Band-pass input filter frequency response.

thing like that of Figure 2. It should be reasonably flat across the top, within 0.5 db or so, from 2000 cycles to about 3100 cycles. If it isn't, try changing the value of capacitance across L_2. Should you have an oscilloscope connected to your TU as a tuning indicator, switch back and forth between the band-pass filter and a jumper plug as you try to copy a weak RTTY signal on 80 or 40 meters. You will quickly see how much noise and QRM is kept out of the TU by use of this input filter.

Band-pass input filter for the Twin City TU.

Twin City TU Modification

Several of the fellows who have built the Twin City TU described last month have independently come up with a suggested modification which simplifies even further the initial adjustment of the unit. Figure 3 shows this modification, which eliminates the original series isolating resistors R_1 and R_2. Apparently, non-uniformity in the diodes made for large variations in the given values for the resistors. The addition of the 250K ohm potentiometer, which should have a linear taper, makes it very easy to balance the discriminator input to get equal values of d.c. voltage, as measured across the 470K ohm load resistors, for MARK and SPACE.

As an additional note, last month we mentioned that the toroids, and the tuned filters themselves, were available from W6CQK. We would like you to note a change of address: W6CQK is now at 1307 Alemeda, Redwood City, California.

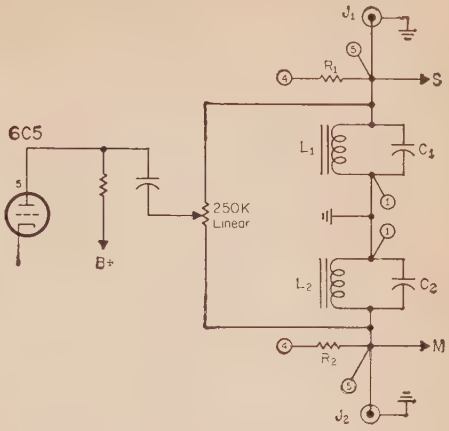


Fig. 3—Twin City TU discriminator modification.

RTTY in Great Britain

The British Amateur Radio Teleprinter Group (BARTG) is now putting out a very informative monthly bulletin. It is in this news sheet that it was reported that the first RTTY official function, the BARTG Dinner, was held November 26th, 1960. Activity in Europe is apparently concentrated on 80 meters with an ever increasing interest in 2 meters. British activity is most obvious to us here in the U.S.A. from the 15 meter activity of G3CQE although G3BXI and G3BDH are also known to be on 20. Most of the machines used are Creed Type 3's which sell for less than $15. American machines in the surplus market bring a comparatively high price, over $100 in most cases, so it is little wonder that the Europeans stick to the C.C.I.T. speed. (See the RTTY column in April 1958 *CQ* for machine speed information.)

Newly active stations are, G3LET, G3MPF, G3LEQ, G3LMR, G3KKY, G3HDG, G3NGA, G3GNR, and G3DSF. PAØFB reports an increase in activity in Holland. Active stations from across the channel are PAØYG, PAØFB, and PAØCDV. G3CQE reports good results on 20 meters with ZL3HJ and VK3KF. VK3KF also works 15 meters. ZS1FD now has a Creed Type 7 machine to complement his TG-7B (Model 15).

The January 10th BARTG Bulletin tells us that reorganization is under way with the object of seeking affiliation with the R.S.G.B. Representing the views of the membership is a governing committee with G6NZ, a Past President of the R.S.G.B., as Chairman. Committee members include such well known amateurs as Bill Brennan G3CQE, the most heard (in the U.S.A.) RTTY DXer; Geoff Bagley G3FHL, SSBer; John Tuke G3BST, well known author of technical articles in British radio magazines; and Allen Partner G3HKT, a very active v.h.f. man. Dr. Arthur Gee G2UK, who gets out the Bulletin, continues as Hon. Sec.

Across the Nation

W1EIZ, Slatersville, Rhode Island, is on 3620 kc regularly and will soon be on 2 meters as well. K1MAM, North Kingston, is another active station in Rhode Island. W1MFJ, Auburn, Maine, has worked out an FSK scheme for his KWM-2. K1CLF, Presque Isle, Maine, now has a Model 15 on 80 meters.

W2VMN, Stittville, New York, was heard working G3CQE on 15 meters. K2HHH is now K8WNE in Birmingham, Michigan. K2SKK has moved to Livingston, New Jersey, home of the 2 meter net. W2QNB expects to be MM/RTTY soon from the *SS E. W. Sinclair* with a 100V and a Model 15. K2BZK, Somerdale, New Jersey, is using a W2JAV transistorized TU with his famed Livingston Radio Club and its autostart Model 15 on 20 meters.

K3GIF, Bethesda, Maryland, was also heard working G3CQE on 15 meters. W3AUD, Altoona, Pennsylvania, is using a Heathkit v.f.o., FSKed a la W6AEE, to drive his home-brew 100 watter. W4NZY, Louisville, Kentucky, uses his model 15 with an AN/FGC-1 and a BC-312 receiver. Bill has a Model 12 for sale—"cheap!" K3DUX is building the W2JAV TU. K4HIA in McLean, Virginia, uses a DX-100 and a W2JAV TU with his Model 15. K4JAC, Savannah, Georgia now has a Model 15 and is building the W2JAV TU.

W5LIW of Ada, Oklahoma, is building the W2JAV TU and will soon have his 15 on 2 meters as well as on MARS. W5ECB of Austin, Texas, is building a W2JTP fork standard. K5EHY reports five Model 15's in the Harlingen, Texas, area. K5ZDW is looking for the Dallas RTTY Society. *(me too!)*

W6VPC, of NCARTS, Inc., reports that a project is underway to secure machines for ZE4JN and for ZE6JG. Ray Morrison, W9GRW, the machine expert of the midwest, has contributed a Model 14 Typing Reperforator towards this project. John and Allan are now building their own converters. W6HAB and W6IXA both have gotten their Model 15's on the air. Bob Weitbrecht, W6NRM, ex-W9TCJ, describes his new "Mark III" TU in the January and February issues of the RTTY Bulletin of the RTTY Society, Inc., of Southern California. ($2.75 per year via W63EE, 372 West Warren Way, Arcadia, California.)

W8SZS has a Model 26 and is attempting to FSK his HT-32A. W8TBZ, Columbus, Ohio, has a Model 15 with sprocket feed. W8TIF is now on Okinawa and has a 14 typing reperforator and TD ready to go. Andy Henderson, W8WYL, will be Chairman of the RTTY Forum at the 10th annual Dayton Hamvention to be held on April 29th, 1961, at the Dayton Biltmore Hotel *(See you there?)*

Potential as well as active RTTYers in the State of Wisconsin should contact the Wisconsin Amateur Teleprinter Association, 5215 Morningside Drive, Greenvale, Wisconsin. KØDZF of Scott City, Kansas, got his Model 15 from MARTS, Inc., and is building a W2JAV TU.

An RTTY station deluxe: WØVBK/AFØVBK/KØVSK

Equipment

RTTY
W2JAV—Converter
Model 15 Page Printer
Model 19 W/T.D.

Transmitters
KWS-1, ARC-3, HT-37

Receivers
75A-4, ARC-3, BC-312, HQ-110

Antennas
Beams on 2, 10, 15, & 20
Dipoles on 40 & 80

Awards
DXCC, WAZ, DUF, OHA, CCC, WAC, TPA, WBE, 101, Ruben Dario, BERTA, CAA.

Clubs & Societies
ARRL, RTTY Inc., MARTS Inc., RSGB, OTC, etc.

Principal Activities
RTTY, MARS, & c.w. DX

Operators
L. M. Divinia, WØVBK
Don Divinia, KØVSK

KØLZF says that there are eight active RTTY stations in Colorado Springs, Colorado. KØAEK is on 20 meters from Denver, Colorado, KØYUS is a new station on from Marshall, Minnesota on 3620 kc. KØZUX is a new station on 52.6 Mc FM from Lauderdale, Minnesota.

Comments

V.h.f. operation, with a.f.s.k., is a very fascinating phase of RTTY operation. Coupled with the use of surplus police FM gear and modified BC-603 war surplus, this brings together all of the RTTYers in a metropolitan area, and its environs, into a big friendly party-line net. 6 meters, 52.6 mc in particular, has proven most suitable for this kind of operation, even where there is a Channel 2 TV station in town. Just to show how easy it is to get on a.f.s.k., we will soon describe a very simple plug-in adaptor for the Twin City TU that provides the a.s.f.k. signal, as keyed by your keyboard, for transmission. Watch for it.

73 Byron, KØWMR

PROPAGATION

George Jacobs, W3ASK
11307 Clara St., Silver Spring, Md.

LAST MINUTE FORECAST

The forecast indices for the month of April, shown in the Propagation Charts following the predicted times of openings, are expected to be related to day-to-day propagation conditions in the following manner:

Forecast Indices	Above Normal Days April 6-7	Normal Days April 1-5, 8, 18-21, 25-30	Below Normal Days April 9-11, 15-17, 22-24	Disturbed Days April 12-14
(1)	C-D	D-E	E	E
(2)	B-C	D	E	E
(3)	A-B	C	D-E	E
(4)	A	A-B	B-C	C-D

Where:

A—Excellent circuit with strong steady signals.

B—Good circuit, moderately strong signals, with some fading and noise.

C—Fair circuit, signals fluctuating between moderately strong and weak, with moderate fading and noise.

D—Poor circuit, signals weak, with considerable fading and very high noise level.

E—Circuit not possible.

During April, especially on disturbed or below normal days, there is a tendency for widespread auroral displays to occur.

FLASH

See this month's Space Communications column for full information on NASA's planned radio propagation satellite.

General Conditions

Springtime propagation conditions continue through the month of April, with fifteen meters expected to be the best band for DX openings during the daylight hours, although considerably fewer openings are expected compared with the winter months. During the daytime hours short-skip openings between approximately 750 and 2300 miles should be best on twenty meters, while forty meters looks best for shorter distances.

Twenty meters is expected to be the best DX band for a few hours after sunset, and during the sunrise period. During the hours of darkness, most DX openings are predicted to occur on forty meters. For short-skip openings up to about 2300 miles, forty meters looks best during the hours of darkness, with eighty meters a close second.

Few ten meter DX openings are expected during April, although some should occur on north-south paths.

Static levels are expected to increase noticeably on all bands during the month.

Short-Skip Charts

Last month this column contained DX Propagation Charts covering the two month period March and April. This month, the column is devoted to a Short-Skip Propagation Chart covering the two month period April and May. Also included are special Charts for use by radio amateurs living in the new states of Alaska and Hawaii.

Tailored more to the needs of the lower power amateur and the Novice, these Charts are based upon a c.w. effective radiated power (ERP) of 75 watts. ERP is the power fed into an antenna, multiplied by the gain of the antenna with reference to a half wave dipole a half wave above ground. A c.w. effective radiated power of 75 watts is roughly equivalent to an ERP of 500 watts a.m., or 150 watts s.s.b. For each 6 db difference between the ERP actually used and these references, adjust the Forecast Indices following the time of band openings shown in the Charts by a factor of 1.

VHF

The occurrence of sporadic-E type ionization begins to increase during April. This should result in a noticeable increase in the number of short-skip openings (between distances of about 750 and 1300 miles) on ten meters, with an occasional opening also possible on six meters.

A relatively large number of aurora-type openings are expected to occur on six and two meters during April. Check the "Last Minute Forecast" at the beginning of this column for those days that are expected to be "below normal" or "disturbed." V.h.f. auroral openings are most likely to occur during these periods.

There's a good chance for some v.h.f. meteor-reflection openings to occur between April 19 and 23, when the Lyrids meteor shower is scheduled to take place.

CQ SHORT - SKIP PROPAGATION CHART

APRIL AND MAY, 1961

LOCAL STANDARD TIME

Band (Meters)	50-250 Miles	250-270 Miles	750-1300 Miles	1300-2300 Miles
10	NIL	NIL	8 A - 10A (0-1) 10A - 3 P (1-2) 3 P - 8 P (0-1)	9 A - 1 P (1) 1 P - 5 P (2) 5 P - 8 P (1)
15	NIL	9 A - 4 P (0-1)	8 A - 10A (1) 10A - 4 P (1-3) 4 P - 6 P (0-3) 6 P - 8 P (0-1)	7 A - 10A (1-2) 10A - 6 P (3-4) 6 P - 8 P (1-3) 8 P - 10P (0-1)
20	NIL	7 A - 12N (0-2) 12N - 6 P (0-3) 6 P - 8 P (0-2) 8 P - 7 A (0-1)	6 A - 8 A (2) 8 A - 10A (3) 10A - 6 P (3-4) 6 P - 10P (2) 10P - 2 A (1)	6 A - 8 A (2) 8 A - 10A (3) 10A - 3 P (4-3) 3 P - 6 P (4) 6 P - 10P (2-3) 10P - 2 A (1-2) 2 A - 6 A (0-1)
40	6 A - 8 A (1-2) 8 A - 10A (2-4) 10A - 7 P (3-4) 7 P - 9 P (2-3) 9 P - 12M (1-2) 12M - 6 A (0-1)	6 A - 8 A (2-3) 8 A - 7 P (4-3) 7 P - 9 P (3-4) 9 P - 12M (2-4) 12M - 2 A (1-3) 2 A - 6 A (1-2)	6 A - 8 A (3-2) 8 A - 5 P (3-1) 5 P - 7 P (4-2) 7 P - 12M (4) 12M - 2 A (3-4) 2 A - 6 A (2-3)	6 A - 8 A (2-1) 8 A - 5 P (1-0) 5 P - 7 P (2-1) 7 P - 2 A (4) 2 A - 4 A (3) 4 A - 6 A (3-1)
80	7 A - 11A (4) 11A - 6 P (4-3) 6 P - 10P (4) 10P - 1 A (3-4) 1 A - 5 A (2-3) 5 A - 8 A (3-4)	7 A - 11A (4-1) 11A - 4 P (3-0) 4 P - 8 P (4-2) 8 P - 1 A (4) 1 A - 4 A (3) 4 A - 7 A (4-2)	7 A - 11A (1-0) 11A - 4 P (0) 4 P - 7 P (2-1) 7 P - 9 P (4-2) 9 P - 1 A (4) 1 A - 4 A (3) 4 A - 7 A (2-1)	7 A - 6 P (0) 6 P - 8 P (1) 8 P - 10P (2) 10P - 12M (4-3) 12M - 5 A (3-2) 5 A - 7 A (1)
160	5 A - 7 A (4-2) 7 A - 9 A (3-1) 9 A - 6 P (2-0) 6 P - 8 P (4-2) 8 P - 5 A (4)	4 A - 7 A (2-1) 7 A - 9 A (1-0) 9 A - 6 P (0) 6 P - 9 P (2-1) 9 P - 4 A (4-3)	3 A - 7 A (1) 7 A - 6 P (0) 6 P - 8 P (1) 8 P - 10P (2-1) 10P - 3 A (3)	2 A - 6 A (1-0) 6 A - 6 P (0) 6 P - 9 P (1) 9 P - 2 A (3-2)

HAWAII

OPENINGS IN HAWAIIAN STANDARD TIME***

TO:	10 Meters	15 Meters	20 Meters	40/80* Meters
Eastern USA	7 A - 12N (1) 12N - 3 P (2) 3 P - 4 P (1)	6 A - 8 A (2) 8 A - 12N (1) 12N - 2 P (2) 2 P - 4 P (3) 4 P - 6 P (2) 6 P - 9 P (1)	1 P - 3 P (1) 3 P - 5 P (2) 5 P - 8 P (4) 8 P - 10P (3) 10P - 2 A (2) 2 A - 4 A (3) 4 A - 6 A (2) 6 A - 8 A (1)	6 P - 7 P (1) 7 P - 9 P (2) 9 P - 12M (3) 12M - 2 A (2) 2 A - 3 A (1) 7 P - 9 P (1)* 9 P - 12M (2)* 12M - 2 A (1)*
Central USA	7 A - 9 A (1) 9 A - 1 P (2) 1 P - 3 P (3) 3 P - 4 P (2) 4 P - 5 P (1)	6 A - 9 A (3) 9 A - 2 P (2) 2 P - 5 P (4) 5 P - 6 P (3) 6 P - 7 P (2) 7 P - 9 P (1)	1 P - 3 P (2) 3 P - 4 P (3) 4 P - 8 P (4) 8 P - 12M (3) 12M - 4 A (2) 4 A - 7 A (3) 7 A - 8 A (2) 8 A - 1 P (1)	6 P - 7 P (1) 7 P - 9 P (2) 9 P - 1 A (3) 1 A - 3 A (2) 3 A - 5 A (1) 7 P - 9 P (1)* 9 P - 1 A (3)* 1 A - 2 A (2)* 2 A - 3 A (1)*
Western USA	7 A - 9 A (1) 9 A - 12N (2) 12N - 3 P (3) 3 P - 4 P (2) 4 P - 6 P (1)	6 A - 8 A (2) 8 A - 11A (4) 11A - 3 P (3) 3 P - 5 P (4) 5 P - 7 P (2) 7 P - 9 P (1)	1 P - 3 P (3) 3 P - 7 P (4) 7 P - 10P (3) 10P - 4 A (2) 4 A - 6 A (3) 6 A - 8 A (4) 8 A - 1 P (3)	4 P - 6 P (1) 6 P - 8 P (2) 8 P - 3 A (4) 3 A - 5 A (3) 5 A - 6 A (2) 6 A - 7 A (1) 6 P - 8 P (1)* 8 P - 3 A (3)* 3 A - 4 A (2)* 4 A - 6 A (1)*

***Hawaiian Standard Time is equivalent to:

Eastern Standard Time minus five hours;
Central Standard Time minus four hours;
Mountain Standard Time minus three hours;
Pacific Standard Time minus two hours.

ALASKA

OPENINGS IN ALASKAN STANDARD TIME**

TO:	10 Meters	15 Meters	20 Meters	40/80* Meters
Eastern USA	NIL	12N - 1 P (1) 1 P - 4 P (2) 4 P - 5 P (1)	4 A - 6 A (1) 2 P - 5 P (1) 5 P - 7 P (2) 7 P - 10P (1)	11P - 3 A (1)
Central USA	NIL	2 P - 4 P (1) 4 P - 5 P (2) 5 P - 6 P (1)	4 P - 6 P (1) 6 P - 8 P (2) 8 P - 10P (1)	12M - 3 A (1)
Western USA	NIL	3 P - 5 P (1) 5 P - 7 P (2) 7 P - 8 P (1)	7 A - 12N (1) 12N - 4 P (2) 4 P - 8 P (3) 8 P - 9 P (2) 9 P - 11P (1)	12M - 4 A (1)

**There are four different time zones in Alaska. This chart is based on standard time in the zone from Skagway to 141 degrees west longitude. Time in this area is equivalent to:

Eastern Standard Time minus four hours;
Central Standard Time minus three hours;
Mountain Standard Time minus two hours;
Pacific Standard Time minus one hour.

FORECAST INDICES

Circuits Forecast To Open:

(1) Less Than 7 days during each month of forecast period.

(2) Between 8 and 13 days during each month of forecast period.

(3) Between 14 and 22 days during each month of forecast period.

(4) For more than 22 days during each month of forecast period.

Where two forecast indices are shown within a parenthesis the first applies to the forecast for the shorter distance range, and the second to the forecast for the longer distance.

A - A. M. P - P. M. N - Noon M - Midnight

See the "Last Minute Forecast" at the beginning of the column for the relationship between the Forecast Indices and the day-to-day propagation conditions expected during the month of April, 1961.

*Indicates times for expected 80-meter openings from Alaska and Hawaii to other areas of the United States. On nights when atmospheric noise conditions are exceptionally quiet, 160-meter openings may also occur during these same time periods.

The CQ Short-Skip Propagation Charts are based upon a CW effective radiated power of 75 watts from a half-wave dipole antenna, a half-wave above ground. The Charts are valid through May 31, 1961. These forecasts are based upon basic propagation data published by the Central Radio Propagation Laboratory of the National Bureau of Standards, Boulder, Colorado.

Sunspot Cycle

The Zurich Solar Observatory reports a monthly sunspot number of 53.5 for January 1961. This the lowest monthly sunspot count recorded since December 1955.

January's low solar activity reduces the latest smoothed sunspot number, centered on July 1960, to 107. The sunspot cycle is based on the smoothed, or 12-month averaged sunspot number. A smoothed sunspot number of 83 is predicted for April 1961, as the present cycle continues to decline.

Sunspot Story

Part I of a special three-part propagation report entitled "The Sunspot Story; Cycle 19—The Declining Years" begins in this issue of *CQ*. The report deals with the declining years of the present sunspot cycle, and how they will influence propagation conditions in the various amateur bands.

Part I, appearing this month, describes the ionosphere in general, and how it makes possible shortwave radio communications. Part II, which will appear next month, will discuss sunspots, their general behavior, and their influence on radio propagation conditions. Included in Part II will be a sunspot forecast for the remainder of the present cycle, and for the remainder of the century.

Part III, to appear in June, will contain a band-by-band forecast of propagation conditions expected during the next five years, and some suggestions for getting the most out of each band.

The report should be of considerable interest and value to all radio amateurs.

73, George, W3ASK

Space Communica.

by DONALD L. STONER, W6TNS
P.O. Box 137, Ontario, Calif.

GEORGE JACOBS, W3ASK
11307 CLARA STREET
SILVER SPRING, MARYLAND

Ionosphere Beacon Satellite S-45

At the time that these words are being written, at Cape Canaveral the National Aeronautics and Space Administration (NASA) is about to begin its countdown for firing America's elaborate Ionospheric research satellite, S-45.

Once in orbit, S-45 is expected to be a most valuable scientific tool for studying the ionosphere—that gaseous, electrified region in the earth's atmosphere, extending from about 50 to several hundred miles high. The ionosphere makes long distance communication possible by reflecting high frequency radio signals over great distances.

The launch vehicle chosen for this experiment is the Juno II, a 60-ton four-stage rocket. If the S-45 goes successfully into orbit, it will be assigned an *Explorer* name and number (probably Explorer IX) to indicate that it has joined the other 36 United States satellites which have contributed much to the world's knowledge of the space environment.

Aboard the 30 inch diameter, 24 inch high, 75 pound research satellite are six radio frequency channels operating simultaneously on approximately 20, 40, 41, 108, 360 and 960 mc. A six foot loop antenna around the satellite's waist is used for the 20, 40 and 41 mc. transmissions, while a 19¾ inch long spike antenna, mounted in front of the satellite along the spin axis, radiates the 108, 360 and 960 mc. signals. (See Figures 1 and 2.)

Transmissions from S-45 will be received at several scientific installations that are participating in this research program. Measurement of the satellite's six transmissions, simultaneously traversing the ionosphere, are expected to yield considerable data which should be valuable for improving the reliability of present long distance communication techniques. Such data is also expected to provide space propagation knowledge upon which future satellite communication systems may be designed.

Satellite receiving stations participating in this program are located at Stanford University, Stanford, California; University of Auckland, Auckland, New Zealand; University of Illinois, Urbana, Illinois; Pennsylvania State University, University Park, Pa.; and the Central Radio Propagation Laboratory of the National Bureau of Standards, Boulder, Colorado. Part-time re-

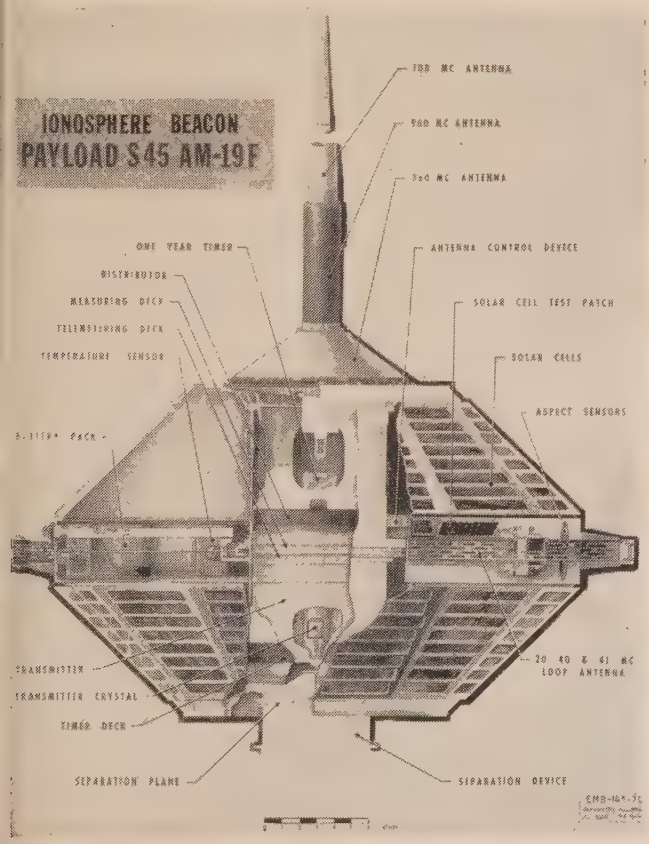


Fig. 1 — Major components of the Ionosphere Beacon Satellite (S-45). Radio amateurs can participate in this satellite's ionosphere and radio propagation research experiments. *(Official NASA Photo).*

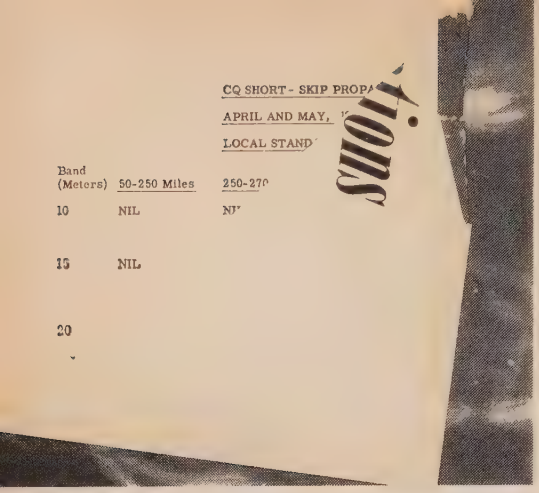


Fig. 2—Artist's concept of the S-45 satellite in orbit. Note 20, 40 and 41 mc antenna around satellite's waist, and 108, 360 and 960 mc antenna jutting out from the satellite's nose. When the satellite is successfully placed into orbit, it will be given a number in the Explorer series. *(Official NASA Photo).*

ceiving stations are also located at the University of Hawaii, Honolulu, Hawaii; Baker Lake, NWT, Canada, and Huancayo, Peru.

NASA's world-wide Minitrack network will track the satellite as it orbits the earth approximately once every 115 minutes, at heights ranging between 240 and 1600 miles.

Transmitter & Frequencies

S-45's transmitter consists of a single crystal from which is derived six different harmonic outputs. Each harmonic output is fed into a separate radio frequency channel. The basic oscillator frequency is 1.00025 megacycles per second; the six transmitting frequencies are harmonics of this basic crystal frequency, rang-

Frequency mc	Estimated Power Output milliwatts	Estimated Radiated Power milliwatts
20.005	300	160
40.010	100	40
41.01025	100	40
108.027	20	20
360.09	100	100
960.240	10	10

This is the largest number of frequencies to be used by any satellite to date.

The frequencies used on S-45 are expected to be exceptionally stable. A unique heat filter surrounds the crystal which eliminates alternating changes in crystal temperature as the satellite passes from sunlight into the earth's shadow. The transmitter is also unique in that it employs high-efficiency capacity diode harmonic generators and transistor radio frequency amplifiers to obtain an overall power efficiency of 35%.

Telemetry and Power Supply

Telemetering will be done on the 108 mc frequency. A total of 14 channels will relay information about the temperature inside the satellite, voltage of the main power supply, instrument calibration and several other satellite functions. No scientific data concerning the ionosphere will be sent back by telemetry; all such information will be derived from direct measurements of the six simultaneous transmissions by ground receiving stations.

The power supply consists of both solar cells and nickel cadmium batteries which are planned to operate the payload continuously up to about 13 months, when an automatic timer is scheduled to cut off the transmitter so that the frequencies can be made available for other projects.

The solar cell arrangement, consisting of a total of nearly 2,600 cells on the lower and upper cones of the payload, covers an area of nearly 750 square inches. Nominal output of the main power supply is 15.4 volts.

Radio Amateur Participation

The 20 mc channel used by the S-45 satellite should allow radio amateurs and shortwave listeners all over the earth to participate in this scientific study of the ionosphere. The relatively powerful transmission on 20.005 mc is expected to be received quite easily on a communication receiver, and it should be located without difficulty since it is in the pass-band of the popular WWV channel. Reception of the remaining frequencies will require somewhat more elaborate receiving equipment and directional antennas.

Reception reports on S-45's transmissions from radio amateurs and shortwave listeners could be a valuable contribution to the research program. Reports of reception should include *exact time* of signal peaks, Doppler shifts, etc. Special attention should be given to any unusual signal qualities such as flutter fading, sudden signal drop outs, etc.

The following scientists have the responsibility for publishing results of the S-45 research program. Reception reports should be sent to the nearest scientific installation for evaluation.

Mr. Fernandez de Mendonca
Radio Science Laboratory
Stanford University
Stanford, California

Dr. J. E. Titheridge
University of Auckland
Auckland, New Zealand

Mr. Robert S. Lawrence
National Bureau of Standards
Central Radio Propagation Laboratory
Boulder, Colorado

Dr. G. W. Swenson
Department of Electrical Engineering
University of Illinois
Urbana, Illinois

[*Continued on page 101*]

by DONALD L. STONER, W6TNS
P.O. Box 137, Ontario, Calif.

semiconductors

Ever since the introduction of transistors, more than 10 years ago, amateurs have been dreaming of high power mobile rigs operated directly from the automobile battery. The unit to be described, while certainly not in the high power class, is about the closest thing to it at the current state of the art.

The transmitter shown in the accompanying schematic was designed by Mr. Joe T. Pierce, of Texas Instruments, Inc., of Dallas, Texas, and is described in a recent technical report. Although intended for use as a marine transmitter, on the 2.1 to 2.8 mc. "fishing boat frequencies", it is capable of producing 15 watts of output, with 100 modulation, on the 75 meter phone band!

A quick look at the Lafayette catalog, after digesting the schematic, will reveal that the T.I. 2N1046 transistors cost $10.00 each and three are used in this circuit. Before you get that "this is not for me" feeling in your pocketbook, consider this. The transmitter operates directly from the automotive 12 volt system (no, it will not work on 6 volts) and therefore no transistorized power converter is required for high voltage generation. This is a savings of at least $15.00 if you have to purchase the switching transistors and transformer. Further, I cannot think of any rig you could purchase for $30.00 which would put of this kind of power. What it boils down to—if you are looking for a 75 meter phone rig for the car, which puts out about 15 watts, the T.I. transistors are a good investment even at 10 bux a crack. The rig is well designed, and not marginal, so you need not worry about destroying transistors.

The Circuit

The report presents circuit design and performance data on Texas Instruments 2N1046 germanium transistor, when used in marine transmitter applications. By reducing the coil turns data given, by 5%, the unit will tune up on the 75 meter phone band. Marine transmitters require a minimum of 15 watts input power to the final. Therefore, a transistor for these applications must have adequate power gain and power dissipation of more than 5 watts. The 2N1046 which has a 30 megacycle f_t (the frequency at which the forward current gain, h_{fe}, is unity) and a power dissipation rating or more than 30 watts should perform well in marine and amateur transmitter applications.

The schematic diagram of the transmitter using the 2N1046 is shown in Fig. 1. This transmitter delivers 20 watts of r.f. power to a 5 ohm load at 2.18 mc. Five ohms is the estimated value of the real part of the antenna impedance used in marine and amateur radio mobile transmission. The advantages of this

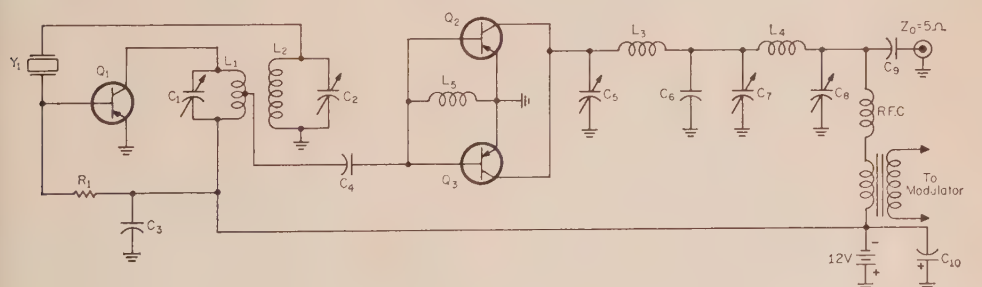


Fig. 1—Schematic diagram for the 20 watt, 2.18 mc marine radiotelephone transmitter.

C_1, C_8—340-1070 mmf *Arco* trimmer.
C_2, C_5—550-1600 mmf *Arco* trimmer.
C_3—0.2 mf disk ceramic (two 0.1 mf in parallel).
C_4, C_9—0.4 mf disk ceramic (four 0.1 mf in parallel).
C_6—0.0015 mf silver mica.
C_7—20-730 mmf variable (2 sections, 10-365 mmf per section).
C_{10}—10 mf, 50 v.d.c. electrolytic.
L_1—8 turns #17 Formvar wound around L_2 (L_1 tapped 4 turns down).
L_2—2" length of *Air Dux* #1210 (7.8 μh).
L_3, L_4—1⅜" length of *Air Dux* #1210 (4.0 μh).
L_5—1¾" length of *Air Dux* #1010 (4.7 μh).
RFC—2" length of *Air Dux* #1016 (14 μh).
R_1—4000Ω, ½ watt carbon.
Q_1, Q_2, Q_3—2N1046 or 2N1908.
Y_1—2.18 mc crystal.

transmitter include direct operation from a 12 volt battery, power dissipation of any sort only when transmitting (no tube heaters), and most important, reliability.

Transistor Q_1, a 2N1046, is used as a crystal controlled oscillator. The output parallel resonant circuit, L_1 and C_1, *is tuned to the crystal* frequency. The oscillator is matched to the succeeding power amplifier by tapping down on coil L_1. The feed back path to the base of Q_2 is through L_2, C_2, and the crystal. This network is also tuned to the crystal frequency and an impedance step-up of 9:1 exists between L_1 and L_2. This impedance transformation is necessary because the low transistor output impedance (approximately 20 ohms) would otherwise shunt the crystal and prevent proper feedback to the base. Resistor R_1 provides 3 ma of forward bias to the base-emitter diode. The oscillator delivers two watts to the input of the power amplifier.

The design considerations for the power amplifier should be of particular interest to transistor experimenters. The major steps in r.f. power amplifier design are: (1) selection of the load impedance (impedance seen at the transistor output terminals), and (2) design of a network to match the antenna impedance to the load impedance. The load impedance (RL) is given by:

$$R_L = \frac{V_{cc}^2}{2\,P_O} = \frac{(12V)^2}{20 \text{ watts}} = 7 \text{ ohms.}$$

where:

V_{cc} = battery supply voltage (12 volts)

P_o = power output required from each transistor (10 w)

Thus the matching network must transform the 5 ohm antenna impedance to 7 ohms at the output terminals of the transistor. Obviously the antenna could be driven directly by the generator and an excellent impedance match would be obtained. However, the operating Q of such a circuit would be so low that severe harmonic generation would occur. Thus a pi-matching section must be used. In fact a double section is used to first, step the impedance up, then back down to 5 ohms.

The matching network should perform the following functions: (1) match the antenna impedance (R_o) to the load impedance (R_1) and (2) properly attenuate any harmonics present at the transistor output terminals. For proper attenuation of harmonics, the Q of a matching network should be at least 10. A double pi-network is used because of the Q of a single network is too low. The Q of a single pi-network is given by:

$$Q = \sqrt{\frac{R_L}{R_O}} = \sqrt{\frac{7}{5}} \cong 1.2$$

In the double pi-network, R_o is transformed to an intermediate impedance R_1', which in this case is 500 ohms, by the first pi-section (see

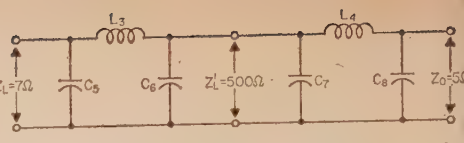


Fig. 2 — Impedance matching double pi-network, used in the 20 watt transistor transmitter.

Fig. 2). The second pi-network transforms R_1' down to R_1 at the transistor output terminals, Then the requirements for Q are fulfilled.

In Fig. 1, coil L_1 provides the d.c. return for the base current. The transistors are parallel connected and no balancing circuit is required. Coil L_3, in conjunction with C_5, C_6 and C_7, provide the input impedance matching. Coil L_4, C_8, C_7, and C_8 make up the output section. An r.f. choke serves as the d.c. return for the collector current, which flows through the secondary of the modulation transformer, T_1.

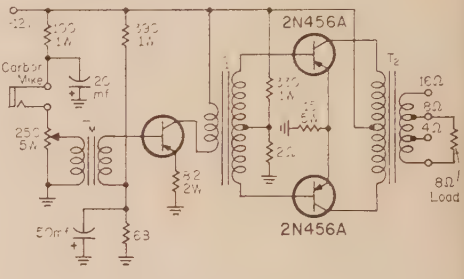


Fig. 3—30 watt class B modulator used in conjunction with the 20 watt output transmitter.

The modulator consists of a Class B power amplifier which is driven by a Class A amplifier (see Fig. 3). The Class A stage is driven by the microphone transformer and a gain control is provided by means of the potentiometer. The range of d.c. current in the microphone is 30 to 80 ma. The Class A driver amplifier has an idle current of approximately 180 ma. The dissipation with no input signal is approximately 1.7 watts. The Class B amplifier has a power output capability of approximately 30 watts. To reduce the cross-over distortion, the transistors draw a total idle current of approximately 10 ma.

Performance Data

At 2.18 mc, the power amplifier delivers twenty watts of carrier power to a 5 ohm load. The collector efficiency of the power amplifier is approximately 65. The overall efficiency of the transmitter is 56 as compared to the 2 to 4 usually found in a vacuum tube transmitter.

VHF Class C Amplifier

A recent Texas Instruments advertisement carried the circuit for an extremely powerful 220 mc Class C power amplifier. The schematic is reproduced in Fig. 4. Two 2N1142's, parallel connected and operated in the common base mode, are used to generate in excess of one-third watt of power output at 220 mc. It is pos-

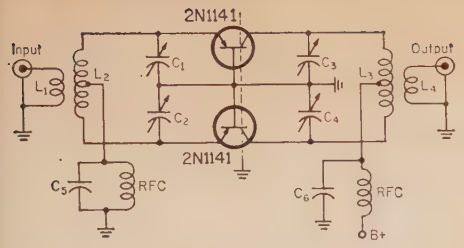


Fig. 4—Schematic diagram for the one-third watt output 220 mc. Class C amplifier.

sible to obtain almost four-tenths of a watt at 220 by using the 2N1141, but they are much too expensive for the average amateur. The 2N1141, 2, and 3 series geranium mesa transistors provide a maximum dissipation of 750 mw (¾ watt) at 25°C case temperature, 35 volts at 100μa I_c, and an F_{max} to 750 mc. A group of driving sources, and more information on this amplifier, will be found in the Texas Instruments application brochure on this series of transistors.

Thyrector Diode

The latest semiconductor "tool," introduced by General Electric, is called a Thyrector Diode. It is basically an a.c. surge voltage protective device. The T.D. acts as an insulator up to 100% of a silicon cell's rated voltage and as a conductor over 100% of the rated voltage. It is a specially processed selenium rectifier with reverse characteristics altered to produce a very sharp I versus E trace, as shown in Fig. 5. When

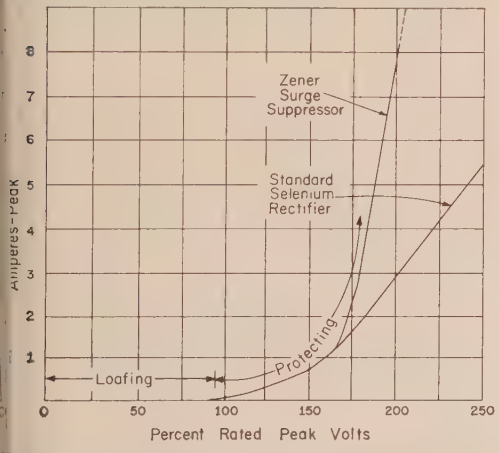
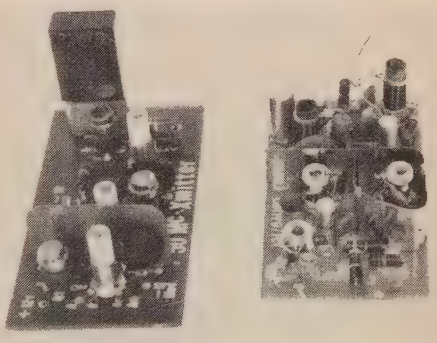


Fig. 5—Graph showing the effect of using General Electric's new Thyrector Diode for protecting silicon rectifier cells.

an excessive voltage tries to appear, the Thyrector dissipates the surge energy instantly. Following the surge, the Thyrector immediately returns to its normal, high-resistance state and stands by, ready to protect against the next transient. This "zener type" characteristic makes the Thyrector Diode very effective for voltage surge suppression. It is particularly well suited for protecting silicon diodes from such transients. In addition, the Thyrector Diode allows the circuit designer to use lower PIV silicon rectifiers with a predictable safety margin and at lower cost. The device, which costs $1.65, should eliminate any destruction of silicon rectifiers due to surges or voltage transients.

General Electric Company has introduced two new time saving wall charts which assist in the selection of optimum silicon and germanium rectifier components for basic circuits. The Rectifier Selection Chart will indicate the optimum device to be used based on the following parameters: average amperes per cell, recurrent peak reverse voltage (PRV) and temperature. This chart, (ECG-545) and Characteristics of Common Rectifier Circuits (ECG-546) may be obtained by writing to the General Electric Co., W. Genesee St., Auburn, New York.

The latest issue of Hoffman's *SPAN* contains an interesting discussion of Photovoltaic Readout Circuitry and features many circuits employing tunnel diodes and readout cells for pulse generator, r.f. switching and modulator applications. You can get on the mailing list by requesting it on your company letter head, to Hoffman Electronics, 1001 Arden Drive, El Monte, California. Also available from Hoffman is a "down-to-earth" discussion called Understanding Solar Measurements, in conjunction with their solar energy conversion cells.



Closeup view of the 50 mc. station featured several months ago in the semiconductor column.

Pacific Semiconductors, Hawthorne, California, have announced a new series of military type high voltage silicon cartridge rectifiers, 1N1731, 1N1733 and 1N1734. These devices have PIV's of 1500, 3000 and 5000 volts respectively. A new 24-page brochure, "Special Assemblies" gives detailed information on the line.

Radio Corporation of America has just revealed a new semiconductor device, called a "Siamese-Twin" transistor because it combines two identical transistors in one package. Actually, two silicon transistors share a common collector. It will be offered initially as a d.c. chopper amplifier for converting d.c. to a.c. and then converting it back to d.c. again. Planar structure, a radically new technique for building transistors, in such a way that all its electrically

[*Continued on page 115*]

YL

by Louisa B. Sando, W5RZJ
212 Sombrio Drive, Santa Fe, N.M.

CR7 YLs

A nice letter from CR7LU, Lucia, tells of visiting other Mozambique YLs during her last vacation. At Inhambane she met Helena, XYL of CR7FU, and Manuela, daughter of CR7ET. These YLs are licensed and operate as 2nd operators. Also Natalia, CR7IW's XYL, at Beira, is licensed. There are only two YLs with their own calls—Lucia and Lina, CR7EO, at Lourenco Marques. Lina is very active on 10 meters. All of these YLs work on all bands and operate phone. CR7LU works c.w. only. Her standing in Dec. was 183 countries confirmed. Lucia is QSL Manager for CR7 and also awards custodian—two big jobs.

CR7LU, Lucia (left), and Natalia, XYL of CR7IW, and 2nd operator of his station.

DX Notes

From ZS6GH, Diana, we hear that the South African Women's Radio Club is carrying on with the same officers as in 1960: ZS6GH, Pres.; ZS6YL, Toni, V.P.; ZS6KK, Marie, secy.; and Diana and Toni co-editors of "YL Beam." Certificate Custodian is ZS1RM, Margery.

ON4AD is the new call for Jane, formerly OQ5IE at Stanleyville in the Belgian Congo. Her QTH is Raversijde, Belgium.

German Anniversary Party

Ella, DJ3TP, sends an invitation to YL and XYL operators throughout the world to participate in the German radio operators Anniversary Party to be held May 20-21, 1961, at Dortmund, and during which the YL operators will hold a special meeting. Anyone planning to attend can contact Ella for information on hotels, etc.

Furthermore, so that they may become better acquainted with YLs who cannot attend, Ella will set up an exhibition and would like you to send her any of the following material: QSL cards, photos, newspaper clippings, reports of special QSOs, lists of YLs (in clubs, nets, etc.). And if you will send information as to bands you operate and times (GMT) she will compile it for the exhibition. Address DJ3TP, Ella Reimann, Roth, Krs. Pruem/Eifel, Zollhaus, Germany.

CR7EO, Lina, is active on 10 meters.

CR7FU (left), and his XYL, Helena, and CR7ET (right) and his daughter Manuela. Both YLs are licensed as 2nd operators.

DX'er—K2UKQ

Mentioned above are a few of the DX YL's—here are two of our YLs who have been so successful in chasing DX.

K2UKQ, Kay Gaynor, at Orange, N.J., works c.w. only. She has earned an impressive record of DX which includes DXCC 222/213, WAZ, 1st YL to make c.w. WPX (440 confirmed), TOPS, AHC (1st W/K YL), Maritime Mobile #304 but #3 on c.w.; 1st YL for the U.N. award, 1st YL for WAG, CHC, and 1st Ham to earn HTH award. Kay has worked 50 DX YLs. Her "secondary illness"—award chasing—has netted her about 40 awards, of which 28 are for DX work.

K2UKQ, Kay Gaynor, has earned an impressive DX record working c.w. only.

Kay was the first Ham in her family—the bug having bitten after she received the gift of an S-38D receiver and along with listening to foreign commercial stations discovered the Hams. Kay got her Novice ticket in Aug. '56 and her General almost exactly a year later. As a Novice she worked 47 States and Hawaii and Puerto Rico—that was when the DX bug bit. With her General she worked W7CQP to complete WAS on 40 c.w. Dipoles were used for most of her DXing, but it took a quad that son-in-law W2IMU put up for her to snag FB8CJ for her 40th Zone and WAZ. K2UKQ uses a Valiant transmitter and an HQ170 receiver.

Kay claims no other hobbies—DX chasing and related activities take up all her time. She has a daughter, Nora, who is K2OJO, and a son, Gil, not a Ham. Kay feels the responsibilities one assumes with DXing are tremendous—QSLs, correspondence, etc. But she feels she is doing a "minute" service to our country, along with thousands of other operators, in making friends of all the peoples that make up this small world.

K5BGT

Another YL with an enviable DX record, accomplished mostly on c.w., is K5BGT, Noma Dee ("Chic") Tilley, of Albuquerque, N.M. Chic holds DXCC 217/200, WAZ, 599-c.w.-WAC (1st YL to receive this), WAVE, WAE I & II, DUF I, II, III, WBE on both c.w. and

K5BGT, "Chic" Tilley, is another YL with an enviable record, accomplished almost entirely on c.w.

phone, and many others. Her WAS and WAC were earned as a Novice, the 2nd YL to accomplish this. Chic began with a Novice license in May '55, after a car accident caused a back injury with resulting spinal operation and a year's convalescence. She got her General in July '56, but was already well on her way in search of DX.

One of K5BGT's aims has been to work all of the USSR countries. Over 100 USSR station contacts have netted her the following: UA1, 2, 3, 4, 6, 9, Ø; UB5; UC2; UFC; UI8; UJ8; UL7; UM8; UN1; UO5; UP2; UPOL6 & 7; UQ2; UR2.

The Tilleys are a 100% Ham family. OM is Joe, K5BGS (strictly phone), and they have three sons at San Diego who are K6UZP, Jimmy; K6BLQ, Jerry; and K6HDZ, Johnny, all 6 meter enthusiasts. Chic does find time for other hobbies, among them playing an electronic organ, gardening (she loves roses), and ceramics. She has her own kiln and teaches classes as well as making many things for family and friends.

Helped by Ham Radio

K5BJU, Harriett, had a most interesting experience last fall when she assisted a couple from Lima, Peru. It started in mid-August with a contact to Lima and Harriett's arranging for an ambulance to meet a seriously ill heart patient arriving with his wife and doctor from Lima. During the six weeks Julio Gomez-Sanchez was in the Methodist Hospital at Houston his wife Nelly was a guest in Harriett's home, and for the 2½ weeks of Dr. Garcia's stay Harriett kept nightly skeds for him with Lima. After three major surgical heart operations, which were successful, the couple returned to Peru.

Then in mid-November Harriett assisted in making arrangements with the same heart surgeon for a 7½ year old boy from Lima and his father to come to Houston for the boy's heart surgery. They talked from Texas Children's Hospital to their family daily during the first week and when the boy left the hospital they stayed with the Woehst family until the doctor released the boy to fly home in mid-Dec. Harriett adds, "We have many loved ones in Peru as a result of our emergency and hospital traffic —thanks to a fabulous hobby!"

Novice Bulletin

A letter from WA6CYT, Keith Lamonica, who is 18 and a senior in high school in Eng-

[*Continued on page 119*]

The Cor-Mac 2 Meter Quad

Lee Aurick, W2QEX
Technical Editor, CQ

The combination of light weight, extreme portability, and recognizable gain in an antenna, even at 2 meters, is calculated to be of great interest to v.h.f. buffs, as well as Field Day enthusiasts.

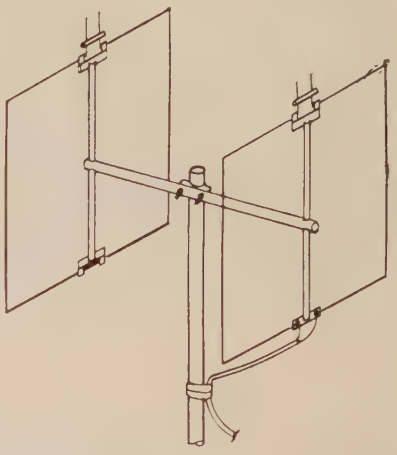
The new Cor-Mac quad for 2 meters, about to be announced, combines all of these features with a few that are inherently its own.

The antenna consists of a stub tuned driven element and a stub tuned reflector both made of hard drawn aluminum wire. The elements are spaced a quarter wave apart on a tubular aluminum boom. The vertical uprights supporting each element are positioned in slotted holes at each end of the boom, and secured by a nut and bolt that contracts the slot and firmly clamps the upright. When necessary to stow the quad away as on FD and other portable occasions, the antenna may be folded nearly flat.

The quad is designed in the standard configuration for this type of antenna, with stubs at the top of each "loop". Each element comprises a full wavelength total, with the vertical and horizontal members each a quarter wavelength long. The driven element is 20 and three-quarter inches on each side and the reflector is 22 inches on each side.

A month of using this little quad has produced some suprising results. Gain appears to be approximately 5 to 6 db over a reference dipole, and though signal reports are usually down as compared with a much larger array, every station worked with the large array has also been able to copy satisfactorily signals from the quad. This includes several stations more than 100 miles distant, and with very modest power input on this end.

Perhaps the reason for the exceptional performance of this antenna is to be found in the low angle of radiation usually attributed to quad antennas. To further enhance this characteristic, the manufacturer advises that he is now planning to offer stacking kits.



While the front-to-back ratio does not appear to be as great as with a Yagi antenna, the low radiation angle does recommend consideration. In fact, under some circumstances, reports as much as 2 S-units better have been received with the quad.

The antenna is conveniently fed with 70 ohm coax, and though our test conditions provided 50 ohm feed, the v.s.w.r. was measured at 1.2 to 1.

This little bantam antenna weighs only 1¼ pounds and is manufactured by the J. C. MacElroy Co., Inc., 74 Trinity Place, New York 6, New York. ■

Mars Bulletins

Air Force Mars Eastern Technical Net

Sundays 2–4 P.M. EST 3295, 7540, 15715kc

April 2nd — No broadcast today.

April 9th — **Theory Of Speech Communications.** Captain John D. Griffiths, USAF, Rome Air Development Center.

April 16th — **Modern Techniques In Speech Communications.** Captain John D. Griffiths, USAF, Rome Air Development Center.

April 23rd — **Basic Electronics For The Radio Amateur.** Phillip E. Hatfield, General Electric Company.

April 30th — **Custom Building via Home Construction.** Edward A. Neal, General Electric Company.

May 7th — **Telemetry; Its Purpose, Its Function.** Warren Bonney, Tele-Dynamics Division, American Bosch-Arma Corp.

Contest Calendar [*from page 69*]

2nd & 3rd Place—A 2nd degree certificate and a contest badge.

4th & 5th Place—A 3rd degree certificate and a contest badge.

In addition each operator of a winning multi-operator station will also receive a badge.

Additional certificates available:

1. W 100 U for working 100 different Soviet stations.

2. P 6 K for contacting all six continents.

3. P 150 C for contacting 150 different countries.

Contacts made during the contest period can be credited for the above certificates.

Your logs should be mailed no later than May 15th to: The U.S.S.R. Central Radio Club, Att: Chief Judging Board, P.O. Box 101, Moscow, U.S.S.R.

Ed Note

That about sews up the contest activity for this season.

Has anybody received an award for last year's U.S.S.R. contest? I have not heard of any nor have I received the results.

There were many conflicting dates during this Spring contest period. Many of these were avoidable if the involved organizations had taken time to check the established dates of previous years.

It is again recommended that Contest Managers communicate with each other in order to make their activities known well in advance.

I will be happy to act as a clearing house for this information but I must be advised some months ahead of the actual dates.

73 for now, Frank, W1WY

Space [*from page 94*]

Dr. W. J. Ross
The Ionosphere Research Laboratory
Pennsylvanian State University
University Park, Pa.

It must be stressed that accuracy, especially in timing, is of the greatest importance in reporting reception of the S-45's transmissions.

For radio amateurs, observing and reporting reception of the S-45 Ionosphere Beacon Satellite is good practice for what will be expected when Project Oscar, a beacon satellite planned to operate in the amateur 2 meter band, is eventually launched.

California-Australia Moonbounce

On February 10, 1961, a moonbounce voice transmission successfully spanned the approximately 8,000 miles between Goldstone, California and Woomera, Australia.

In this experiment, Dr. Hugh Dryden, deputy chief of NASA, sent greetings from his Washington office to Australian government officials and scientists at a "down-under" deep space tracking station. Dr. Dryden's voice was carried by land-line to Goldstone, California, where a powerful NASA radio transmitter bounced the signal off the moon, 225,000 miles away. Two and a half seconds later, Dr. Dryden's greetings were received loud and clear at the Woomera receiving station.

The 7.5 kilowatt transmitter at Goldstone operated on 960 mc with an 85 foot dish antenna. The Woomera station replied to Dr. Dryden's greetings by way of commercial high frequency radio-telephone, since the station does not have its own transmitting facilities.

Conversations by way of the moon have been carried on before, but not between two such widely separated stations. The U.S. Navy operates a moonbounce circuit on 435 mc between Washington, D.C., and Honolulu, Hawaii. Successful experimental moonbounce transmissions have also been carried out between England and Massachusetts using the giant radio telescope at Jodrell Bank.

Venus Probe

By the time this appears in print, the Soviet Union's space-launched rocket should be nearing its target—the planet Venus.

In announcing the launching on February 12, the Russians stated that one of the main objectives of this deep space probe was to "check radio communication over super-long distances." The announcement also stated that radio transmission from the "automatic interplanetary station" are being made on a frequency of 922.8 mc. Reports from other sources indicate that a second frequency at 126.8 mc (some reports say 126.5 mc) is also being used. Neither frequency is in continuous operation and both appear to be triggered by command from the ground.

If the transmissions from the Soviet's Venus probe are received on earth from distances greater than 22.5 million miles, a new DX record will be set. The present record of 22.5 million miles is held by the U.S. deep space probe Pioneer V, which is now in orbit around the sun.

Project Haverford

In last month's SPACE COMMUNICATIONS, our description of Project Haverford was badly garbled. We apologize for the error and reprint below the corrected paragraphs of the Project Haverford item:

"Despite an initial setback, when fire destroyed much of the equipment the night before the Echo satellite was launched, the tracking station is now almost complete.

"The students at Haverford College have already participated in some interesting projects with their tracking station. This past fall they tracked the unsuccessful NASA moon satellite attempt from the time the satellite appeared above the horizon at Cape Canaveral to when it disappeared over Africa (see Photos). As soon as Professor Benham can obtain a klystron he needs, they plan to conduct moon and Echo-bounce experiments."

That about does it for this month.

73, George, W3ASK

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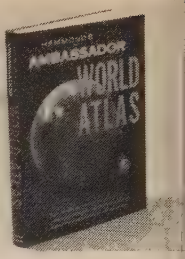

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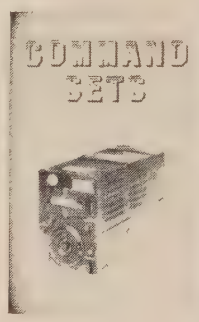

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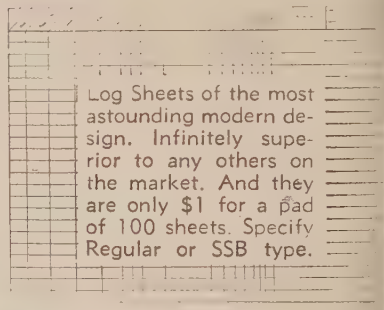

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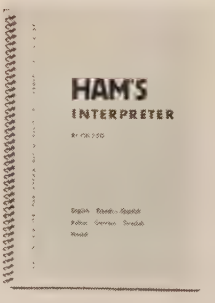

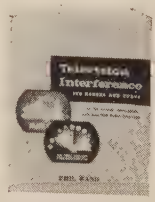

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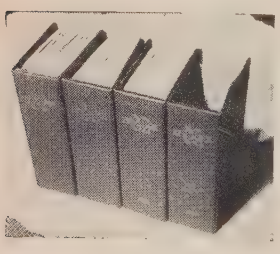

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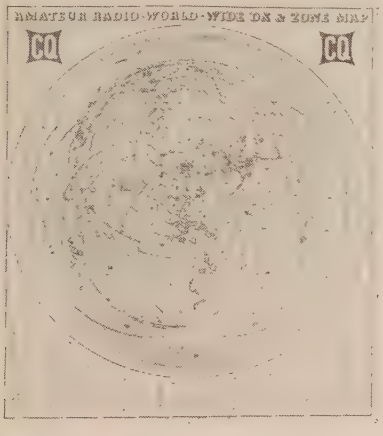

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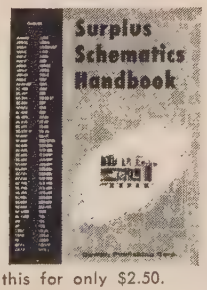

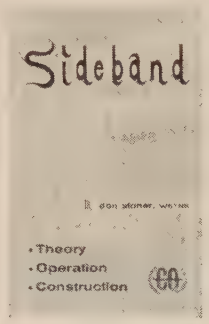

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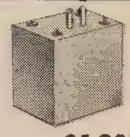

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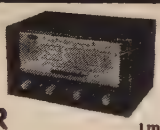

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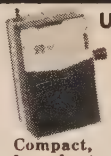

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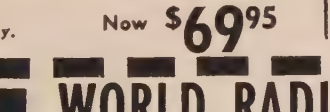

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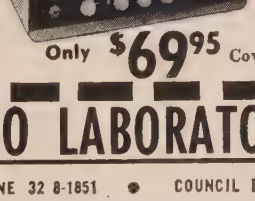

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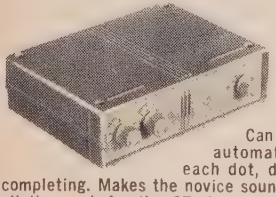
AUTRONIC KEY—For better, faster CW. Easy to use. Velvet touch. Heavy silver alloy contacts. Fully adjustable. Superior quality to last a lifetime. Contact bounce eliminated regardless of lever movement or keying pressure. Properly weighted base will not walk. Attractive and streamlined...3" x 3½". Can be used with any electronic keyer.



AUTRONIC KEYER—For better DX. All transistorized with improved digital circuitry...no relays or tubes. Compact and lightweight for portability. (7"x5"x2") Can be used automatic or semi-automatic. Precisely proportions each dot, dash, and space...all self completing. Makes the novice sound like a pro, and takes out all the work for the OT. Superior readability...makes CW a real pleasure. Instantly variable speed from 6 to 45 wpm. Self contained speaker for monitoring or code practice. Use vertically or horizontally in any type of fixed or mobile station.

ELECTROPHYSICS CORP.
2500 West Coast Highway
Newport Beach, California

See your dealer or write direct for info and prices.

For further information, check number 40, on page 126

Contest [*from page 71*]

A stock excuse is, "I didn't operate 12 hours." Now what has that got to do with you sending in your log? The 12 hour minimum operating time only applies if you are in contention for an award. It's a cinch if you are out to win you are going to put in more than 12 hours.

VK5LD wanted to know, "if he would receive an award for his 15 QSO's or was someone leading him down the Garden Path." I'm sorry "Pop" but I'm afraid someone had you by the hand.

Others objected to taking time out to recopy their logs, but why go to that trouble. We have often suggested that a clean carbon copy of the original is acceptable.

It was good to have KH6IJ back with us after a two year layoff. It just doesn't seem like a contest without Nosey's rapid-fire staccato bursts on all bands.

And Doc, W8WZ "just can't take those 48 deals any more," so he went single band. Neither can I Doc, that's why our contest is growing in popularity each year, the single band feature.

But a DX Contest is probably best described by W4QVJ. George referred to it as "that veritable DXplosion in those pile-ups."

And with that descriptive note we, Andy W1GYE, Mac W2BO, Ben W2JB and yours truly, go back to preparing the Phone results for a complete report next month.

73 for now, Frank, W1WY

FROM THE WAREHOUSE OF
HARVEY RADIO
A VALUE-BUY PARADE SAVES YOU MONEY IN SO MANY WAYS!

CHICAGO TRANSFORMER PHC-70

PRIMARY 117V. AC
SECONDARIES
6.3V. C.T. AT 3 AMPS.
5V. 2 AMPS
300-300 70 MILLS
LIST $23.45
HARVEY SPECIAL $6.50

FH 610

PRIMARY 110V. or 220V. AC
SECONDARY 6.8V. C.T.—
10 AMPS
LIST $26.25
HARVEY SPECIAL $6.50

RH 1585

15 HENRY AT 85 MILLS
LIST $11.40
HARVEY SPECIAL $3.00

ALL THREE ABOVE ARE HERMETICALLY SEALED JAN SPEC CASES AND ARE BRAND NEW —NOT SURPLUS

CHICAGO TRANSFORMER R-65

6 HENRIES AT 500 MILLS
35 OHMS D.C. RESISTANCE
9000 VOLTS RMS INSULATION
WEIGHT 35 LBS.—
7-3/16 X 9 X 9¾
LIST $75.00
HARVEY SPECIAL $22.50

OHMITE RHEOSTATS

50 WATT 3,500 OHMS
SPECIAL $2.00

ELDICO PLATE TRANSFORMERS

5000-500V. AC AT 300 MILLS
HARVEY SPECIAL $3.75

THORDARSON T-19D304 UNIVERSAL DRIVER TRANSFORMER FOR CLASS AB OR B MODULATORS

PRIMARY TO ½ SECONDARY
2:1—2.2:1—2.4:1
RATED 15 WATTS
HARVEY SPECIAL $2.75

AMERICAN MICROPHONES

MODEL D7TPR DYNAMIC MICROPHONE
HIGH IMPEDANCE WITH HANDLE & PUSH TO TALK SWITCH
MODEL D7PR—LOW IMPEDANCE—50 OHMS
LIST PRICE $55.00
HARVEY SPECIAL $12.50 (EITHER ONE)

LOW PASS TOROID FILTER

CONTAINS 5 TOROIDAL COILS IN AN L/C NETWORK—PASS BAND 300 TO 2,500 CPS ± 3 DB—EXTREMELY SHARP
CUT OFF AT 3,200 CYCLES—IMPEDANCE 600 OHM IN AND OUT
HARVEY SPECIAL $9.95

WITHOUT HOLES

DYMO-MITE M-2

Make your own on-the-spot labels on plastic or aluminum tapes. Easy-to-read — will permanently adhere to any surface. Variety of tape colors available.
PRICE $34.95

CORNELL DUBILIER TYPE T

4 MFD AT 2,000V. D.C. WORKING
HARVEY SPECIAL $3.95

JOHNSON MOBILE TRANSMITTER

#240-141-2. 60 WATTS
10-11-15-20-40-75 METERS
GANG TUNED, 100% MODULATION
6BH6 OSC, 6AQ5 BUFFER DOUBLER
807 FINAL—PP807 MODULATOR
LESS TUBES & POWER SUPPLY
HARVEY SPECIAL $89.50 NEW
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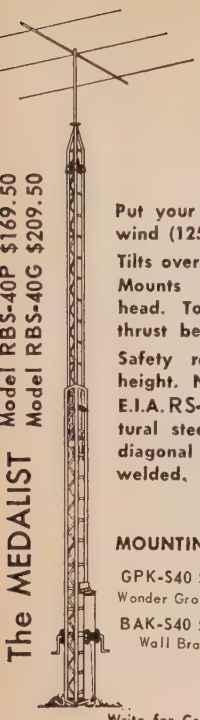
HARVEY is known the world over, as a reliable source for Ham Equipment. All orders shipped same day received. If you want to talk SWAPS and DEALS write or call **W2DIO.**

For further information, check number 26, on page 126



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The MEDALIST Model RBS-40P $169.50 Model RBS-40G $209.50

Put your Tribander at 41' in 70 mph wind (125 mph cranked down to 24').

Tilts over for E-Z access to array.

Mounts Ham-M Rotor inside tower head. Top radial bushing - vertical thrust bearing.

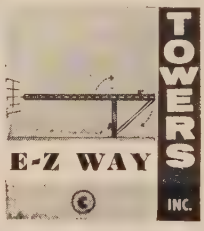
Safety rest locks tower at desired height. No weight on cables.

E.I.A. RS-222 specs. Heavy wall structural steel tube legs, solid steel rod diagonal & horizontal bracing — arc welded. *Sold by Top Flight Distributors Everywhere!*

MOUNTING KITS:

GPK-S40 $75.00
Wonder Ground Post

BAK-S40 $10.50
Wall Bracket



Write for Catalog 22-1

P.O. BOX 5767 TAMPA 5, FLORIDA

For further information, check number 27, on page 126

DOW-KEY DK60 SERIES

4 VERSATILE MODELS A.C. or D.C.

Small, Compact, Light Weight, Less than 9 oz.

COAXIAL RELAYS

Also Available with Type C, TNC, BNC, N & UHF Connectors

Outstanding favorite for amateurs . . . Versatile combinations for industrials! Low VSWR — less than 1.15:1 from 0 to 500 mc. LOW LOSSES . . . High Contact Pressures. LOW CROSS-TALK through use of patented "isolated connector" arrangement. HIGH POWER RATING. All coils encapsuled in epoxy resin for quieter operation and resistance to moisture.

★ UNCONDITIONAL GUARANTEE for one year. (We will repair if faulty within 1 year.)

★ See one of our 700 dealers and distributors in U. S. and Canada for catalog sheets or write:

STANDARD RELAYS: DK60, DK60-G, DK60-2C and DK60-G2C — Priced from $12.45.

Also available with Type C, TNC, BNC, N & UHF Connectors.

May be had with weatherproof boxes for exterior use. Also with ganged, multiple switch arrangement for remote control selection of antennas.

PRICED FROM $12.45

DOW-KEY COMPANY
Thief River Falls, Minnesota

For further information, check number 28, on page 126

NOVICE [*from page 81*]

Help Wanted

W2—William T. Joslin, 115 Bay 40th St., Brooklyn 14, N. Y. Phone ES 2-1399.
Howard Strumpf, 328 Broadway, Lynbrook, N. Y.
Tom Mullin, *S.S. Cape Henry,* Northern SSCO, 39 Broadway, New York 6, N. Y.

W4—SP/4 Lewis M. Jones, 109th QM Co. (AS), Fort Lee, Virginia, phone RE 3-4111, extension 737.

W8—David Morris, Box 48, Allen Junction, West Virginia Sean O'Callighan, 30024 Hohn Hauk, Graden City, Mich. GA 1-3222.

W9—John Nichols, Box 670 Cary Hall, Purdue University, West Lafayette, Indiana.

Letters

Glenn Hammond, KN4 Young Dream Girl (what?), 942 Crescent St., Roanoke, Virginia, is 13 years old and haunts the 80 and 40 meter bands with his Harvey-Wells TBS-50D and Heath AR-3, with a QF-1 helping it along. Glenn has been blasting 'em since last July and plans to take his General ticket exam around April. Look for him on 7190 or 3707 if you would like to work Va.

Gary Thompson, 5147 So. 1900 West, Roy, Utah, is interested in a tunable converter to be used for all band reception in conjunction with a BC-453 Q5'er. Can anyone help him?

Dave Perrin, K1OPQ, 1096 Highland Ave., Needham Heights, Mass., just swung over to the General limb a few months ago, and offers to sked anyone needing Mass. on 80, 40 or 15 meters. Dave chases flies with his Globe Chief Delux into a 40 meter dipole or Mosley TA-32 Jr. beam. The receiver is an NC-98. Dave also offers to help prospective Novices.

Bob Bair, W7WKA, Route 1, Box 361, Parkdale, Ore., has long since graduated from the Novice ranks (Class of '54) but still keeps tabs on the situation. If anyone needs Oregon, or wants a rag-chew, give him a call. He will also help anyone at any c.w. speed. Bob can't make skeds, however, because his working hours aren't regular enough.

Tommy Hyde, KN5FKA, P. O. Box 683, Denison, Texas, gripes about U.S. stations who call Novices sending CQ DX. Tom says "When the operator hears a station calling him, he may stop and listen and it will turn out to be a U.S. operator. That may cause him to not hear a DX station calling him." Tom suggests that Novices not call a station sending CQ DX unless, of course, he happens to be an overseas station.

That reverses our grid drive for this month. Remember to include a little background information, along with your interest and experiences, in your letter. You may be selected as our Noteworthy Novice for the month. Don't be camera shy either. A picture is a necessary prerequisite. For now,

73, de Don, W6TNS

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KWM-2 Transceiver	$1150.00
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516F-2 AC Power Supply	115.00
516E-1 12 V DC Power Supply	270.00
75S-1 Receiver	520.00
312B-3 Speaker	32.00
312B-4 Speaker Console	195.00
30S-1 Linear Amplifier	1556.00

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World's Largest Distributors of Short Wave Receivers

For further information, check number 29, on page 126

CITIZEN BAND CLASS "D" CRYSTALS

All 22 Frequencies in Stock

3rd overtone, .005% tolerance—to meet all F C C requirements. Hermetically sealed HC6/U holders, ½" pin spacing—.050 pins. (.093 pins available, add 15¢ per crystal).

$2.95 EACH

The following Class "D" Citizen Band frequencies in stock (frequencies listed in megacycles): 26.965, 26.975, 26.985 27.005, 27.015, 27.025, 27.035, 27.055, 27.065, 27.075, 27.085, 27.105, 27.115, 27.125, 27.135, 27.155, 27.165, 27.175, 27.185, 27.205, 27.215, 27.225.

Matched crystal sets for Globe, Gonset, Citi-Fone and Hallicrafters Units . . . $5.90 per set. Specify equipment make.

RADIO CONTROL CRYSTALS IN HC6/U HOLDERS

Specify frequency. ½" pin spacing . . . pin diameter .05 (.093 pin diameter, add 15c) ..... $2.95 ea.

FUNDAMENTAL FREQ. SEALED CRYSTALS

in HC6/U holders
From 1400 KC to 4000 KC .005% Tolerance ..... $4.95 ea.
From 4000 KC to 15,000 KC any frequency .005% Tolerance ..... $3.50 ea.

SEALED OVERTONE CRYSTALS

Supplied in metal HC6/U holders
Pin spacing .486, diameter .050
15 to 30 MC .005 Tolerance ..... $3.85 ea.
30 to 45 MC .005 Tolerance ..... $4.10 ea.
45 to 60 MC .005 Tolerance ..... $4.50 ea.

QUARTZ CRYSTALS FOR EVERY SERVICE

All crystals made from Grade "A" imported quartz—ground and etched to exact frequencies. Unconditionally guaranteed! Supplied in:

FT-243 holders
Pin spacing ½"
Pin diameter .093

MC-7 holders
Pin spacing ¾"
Pin diameter .125

DC-34 holders
Pin spacing ¾"
Pin diameter .156

FT-171 holders
Pin spacing ¾"
Banana pins

MADE TO ORDER CRYSTALS • Specify holder wanted

1001 KC to 2600 KC:
.01% tolerance ..... $2.00 ea.
.005% tolerance ..... $2.75 ea.

2601 KC to 9000 KC:
.005% tolerance ..... $2.50 ea.

9001 KC to 11,000 KC:
.005% tolerance ..... $3.00 ea.

Amateur, Novice, Technician Band Crystals

.01% Tolerance . . . $1.50 ea.—80 meters (3701-3749 KC), 40 meters (7152-7198 KC), 15 meters (7034-7082 KC), 6 meters (8335-8650 KC) within 1 KC
FT-241 Lattice Crystals in all frequencies from 370 KC to 540 KC (all except 455 KC and 500 KC) ..... 50¢ ea.
Pin spacing ½" Pin diameter .093
Matched pairs ± 15 cycles $2.50 per pair
200 KC Crystals, $2.00 ea.; 455 KC Crystals, $1.50 ea.; 500 KC Crystals, $1.50 ea.; 100 KC Frequency Standard Crystals in HC6/U holders $4.50 ea.; Socket for FT-243 crystal 15¢ ea.; Dual socket for FT-243 crystals, 15¢ ea.; Sockets for MC-7 and FT-171 crystals 25¢ ea.; Ceramic socket for HC6/U crystals 20¢ ea.
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For further information, check number 30, on page 126

HAM CLINIC [*from page 78*]

500 mmf in place of the two .001 mf coupling condensers to limit the low frequency response. These are at pins 6 and 7 of the 12AX7. Good luck.

MT-1 Heating—"How do I reduce the heating and resultant shortened life of the 6CL6 buffer and 5763 driver tubes in the Health MT-1?"

Write Heath for their complete modification information for the MT-1 (to high impedance driver plate circuitry). I would also like to suggest that you try using heat dissipating shields as advertised in *CQ* by IERC—they really do help.

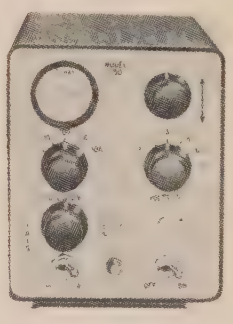
Receiver Muting—"Tell me, how does the connection for receiver muting (in most receivers) work?"

Generally, the center tap of the receiver power transformer is switched (at the front panel) from an open condition to ground. The terminals used for muting are usually bridged with a STANDBY-RECEIVE or TRANSMIT-RECEIVE switch. Most good antenna switching relays have extra relay terminal contacts which are connected to the muting connections. The STANDBY-RECEIVE switch is usually opened and left that way for transmitter (on-the-air) control.

Some receivers may require a bias (from the transmitter) for muting. However, these are far and few between.

Oscilloscope—"I have two questions. The first is, who makes the smallest transistor scope in the world; and second, when will your Ham Scope Book be out?"

Electro Instruments, Inc. of San Diego, California makes the smallest scope (I believe) in the world. See the photo.



"Worlds Smallest Scope" manufactured by Electro Instruments of San Diego, California.

The *Ham Scope Book* is in the final stages of preparation, for publication. Delays due to many circumstances (over which we had no control) prevented getting it out. Please be patient, it will be worth waiting for.

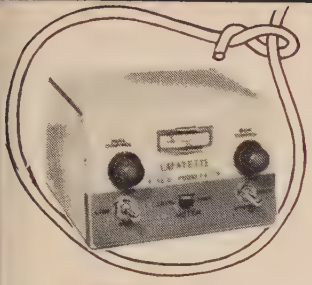
Thirty

Again we appeal to hamdom at large to send in your technical tips. Your fellow hams would appreciate reading what you have done in the way of some technical innovation in your hamshack.

Thank you for reading HAM CLINIC.

72—73 and 75 Chuck

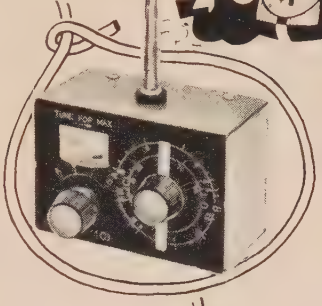
THE LAFAYETTE ROUNDUP OF HAMSHACK VALUES



MODEL HE-26
HYBRID PHONE PATCH

Perfect for AM-SSB Phone Patch operation. VU Meter monitors line level for Q5 phone patches. An unmatched low—

24.50



MODEL TM-15
WAVE METER

Checks transmitter output for harmonics, parisitics, and out-of-band operation. Provided with magnetic feet. Perfect for the novice.

8.95

37.50

HE-28 RF WATTMETER AND SWR BRIDGE

150 watts full scale—Built-in dummy load—Wattmeter ±5% to 54 mcs. SWR ±5% for in line use.

MODEL TM-14
FIELD STRENGTH METER

Complete, no wires to connect. Monitor transmitter output, check antennas, etc. Perfect for mobile, provided with magnetic feet.

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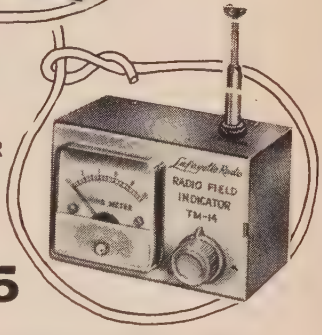

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- R-26/ARC-5 or BC-454—3Mc.-6Mc. Used, Ck'ed Out $8.95
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MODULATORS AND DYNAMOTORS
- MD-7/ARC-5 ..... Used $5.95, Rec. Dyn 12V. $4.95
- BC-456 .....Used $4.95, New—24V. $1.95 Clean

LOCAL CONTROL KIT
Includes All Necessary Parts For Front Panel Control of Eather ARC-5 or BC Series Rec. Entire Kit Including Schematic & Directions $1.95

WINCHARGER DYNAMOTOR—Made for Collins 12V. IN-44 ov at 200 MA .....New $9.95

POWER SUPPLY
110V AC for Command Rec. ..... Kit $ 6.95
Wired $10.95

DYNAMOTOR—12V output, 250 VDC at 100 ma. New, ea. $2.19

Please include approx. Post. Calif. Add 4% Tax. Send Cash, Check or M.O. Prices sub. to change.

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For further information, check number 32, on page 126

Watch R W "Monthly Specials"

BC-603 FM Receiver 20-27.9 Mc. Complete. New! **$14.95**
DM-34 Dynamotor 12v. New ..... $ 2.95
BC-604 FM Transmitter 20-27 Mc. New ..... $ 4.95
DM-35 Dynamotor 12v. New ..... $ 7.95
COLLINS ARC-2 Transceiver 2-9 Mc. Acquisition Cost $2250.00. Shp. Weight 100 lbs. **WHILE THEY LAST! $59.50**

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Club meetings are held at Community Center, 8th & Main Streets, 1930 hours last Wednesday of each month.

Visitors & inquiries invited.

Components Eng. [*from page 56*]

quently revised, widely distributed and ava able through the component distribution cha nels at nominal cost, is a fine example of su literature. Other firms, of course, have ma equally valuable contributions to the industr the RCA publication is merely cited as bei typical of this class.

Do not feel that you are imposing on t manufacturers in your consumption of their l erature. In this fast moving field, the student today may well be specifying components t morrow. It follows that he will specify the pa ticular product which, to his knowledge w best meet the requirement. To the enlighten manufacturer, this is simply delayed action a vertisement, with the good will and future ben fits far out weighing the current cost.

1. File your reference library in a systemat manner, so that required information may quickly located.

2. As you acquire literature, assimilate much information as you are capable of absor ing. Compare the products of one manufactur with those of others. Learn the principal sim larities and differences. Admittedly, this may dry reading at first but, as you learn and your interest develops it will grow on you.

3. In your reading or actual experience wi electronic equipment, attempt to determine w a certain component is used in preference others that are available. Frequently there no apparent reason for a particular design. critical in your evaluation. All too often, ex diency and economic rather than good engine ing considerations govern the design of co mercial equipment.

4. In your work and personal experiment tion which involves component replacement application, investigate all available produc Select the specific product of a particular man facturer that would most perfectly meet the r quirement. Then, if you have to, go ahead a use the junk box part you have on hand. Y are developing your skill and increasing yo knowledge by using these methods. Make the second nature and your progress will be rapi

Comments on this general area of career a vancement are now in order. Rare in this fie are those that command a thorough going know edge and skill in the mechanics of electronic along with the administrative and executive abi ity to fully utilize and direct this talent. Eve more rare is the individual who also possess a detailed knowledge of the logistics of the pr fession. The rewards to such a triple threat ma are very worthwhile. Many technicians ha forged ahead of graduate engineers by dilige application of these skills.

So, whether your interest lies at the scientifi engineering or technical level, the time spe poring over the available manufacturer's liter ture will be of lasting benefit to your career electronics.

sideband reception. I can tune to the BBC or other transmissions of high stability, receiving them with the product detector in the sideband manner, and the 51J-2 is "stable as a rock," providing long-term undistorted reception, even of music, in this manner. The ability to tune the b.f.o. portion of the product detector is not missed at all. Switching from one sideband to the other is done with a flick of the wrist. In a double conversion receiver such as this one, it is not possible to label the switch positions "UPPER" or "LOWER," as their relative right or left hand positions change as frequency bands are switched, due to the h.f. and i.f. conversion system used in the set. However, this is no handicap, as one easily remembers the proper setting for upper or lower sideband on the various amateur bands. In a single-conversion set, such as the Super-Pro for example, the h.f. oscillator is on the same side of the incoming signal frequency on all bands, and labelling of the switch position as "UPPER" and "LOWER" is possible.[1]

These modifications may easily be adapted to almost any model receiver, by proper choice of crystal frequencies to bracket the set's i.f. frequency with a spread of about 2.8 or 3.0 kc between upper and lower sideband crystals. I shall be only too happy to correspond with readers who may wish to try this product detector scheme, and to furnish such suggestions and assistance as may be possible. ■

[1] Lee, Paul H., "Save your Super Pro for Sideband", *CQ* September 1958, page 52.

YL [*from page 97*]

land, where his dad is with the USAF. Since he can do no operating Keith has taken up publishing "The Novice Amateur," a bulletin published monthly and devoted to the Novice. Departments include Skeds, News, QRV (DX stations heard in Novice band), Ham of the Month, Club of the Month, etc. Rates are $2 in U.S. and $2.50 foreign. Of the many Hams expressing interest in the Novice Amateur, none was a YL and Keith would like to hear from some of the Novice YLs. Address him at 7500 Abron, APO 125, New York, N.Y.

YL VHF Contest

Remember the dates of the first YL VHF Contest—April 12-13, 1961. Complete rules were published in March *CQ*.

CQ YL

DX YLs, DX chasers, VHF enthusiasts, emergency work, young YLs, all of the subjects, mentioned here, and many many more—in fact, every facet of Ham radio in which the YLs participate, is covered in the one and only book about the YL's—"CQ YL." 18 chapters over 500 photographs. Order from W5RZJ (QTH at beginning of column), $3, postpaid.

33—W5RZJ

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For further information, check number 45, on page 126

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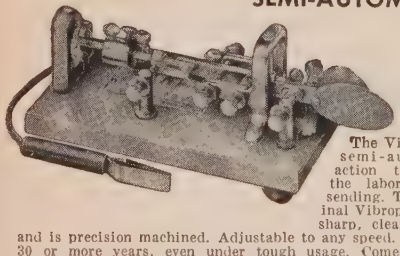

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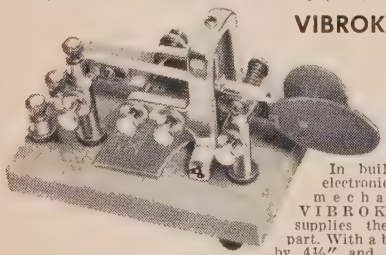

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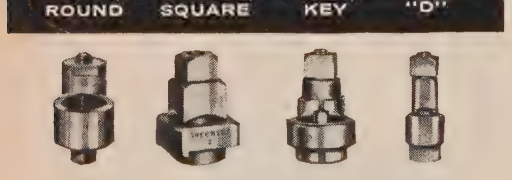

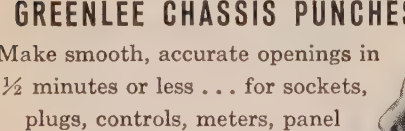

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e over $300.00 on KWM-2 with 516-F2 power supply and -B4 phone patch wattmeter speaker console in A-1 con-on. First $1150.00 takes all. G. J. Fortescue, 140 S. rt, Orlando, Fla. Ph. GA 3-8559.

-3 with 3 and 6 KC filters $300.00. Hallicr. Panadaptor .00; Slicer $20.00; All $345.00—K6PAZ—15330 Oxnard, n Nuys, California, ST 6-9010.

ANTED: *CQ* October 1958. Will pay $3.00. Please write t: Dr. Fort, Knott's Berry Farm, Buena Pak, California.

ANTED: 4-1000A, Air System socket, chimney and dwell 1500 mmf variable capacitor. State price and dition. Box D—c/o *CQ*.

R SALE: SX-100 Receiver, perfect condition, $180.00. rles Alexander, Oswegatchie Rd. Waterford, Conn.

MGEAR. Havsum, wilswap. Watugot? RSVP, K1JVN, nson, Mass.

LL for best reasonable offer: DX-100, SB-10, SX-100. ison: college. Marty—K2MDL, 42 Hemlock Lane, Roslyn ights, New York.

tom built chassis for your pet project. Free estimates. il sketch or print. Browne Elec-Tool Associates, 5501 W. 25th Ct., Hollywood, Florida.

ade or sell: 4 transistor Sonotone "1200" hearing aid h air conduction receiver. In excellent condition. Swap commercial equipment, VHF preferred. Jay Cady, A2ILH. Mayville, N. Y.

w TV Tubes—6198 or 5527—$50.00. W1BYX, Box 122, ckville, Conn.

-300 brand new condition $190. K2TGH, 67-19 172 St., shing 65, N. Y.

ANTED: B&W 850A inductor. UTC S-47 power transmer. UTC S-33, S-34 chokes. Inexpensiver lowpower SSB erator. Larry Kleber, K9LKA, Belvidere, Illinois.

ANTED: transceivers 27.43mc, narrow band, 20F3 emssion. Ham gear. Cash waiting: S. Krzak, Pawtucket, I.

LL: 6′ Rack cab. casters, a beauty! $45; 500w audio d. xfr, $20; 3200v, 700ma power supply, Variac, Screen Bias Supply, Control Relays, ideal for Eimac Tetrodes, 0; Part wired 4-250's Final, $35. All for $195. No Ship. JKJ, 1149 Heatherstone, Sunnyvale, Calif.

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Choke: 8 Hy. @ 200 Ma. (90 Ohms DC Res.) Herm.-Sealed @ $1.75.

Plate Transformer: Pri: 200, 220 or 240 VAC.
Sec: 1400 V.C.T. @ 350 Ma.
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Selenium Rectifier: Internat'l Rectifier Corp. type #3440D, Good up to 50 VAC input (up to 45 VDC out. @ 8 Amps) Full-wave bridge connection for 36 VAC in @ 28 VDC out. 8 Amp. rating very conservative. $9.75.

Merit Choke: 10 Hy @ 250 Ma. #C-3182. $2.95.

RCA Precision 500 KC Crystal Oscillator. Accuracy plus or minus 0.0012%. Contains precision 500 KC xtal. BMS Labs xtal oven, 5840 sub-min. tube. Herm. sld. Mts in stand. 7 pin miniature socket. Only $3.75 w/info. sheet.

RCA Plate Transformer: 1250 V.C.T. @ 360 Ma. Pri: 115 V. w/taps @ 60 CPS. Herm.-sld. $4.95.

RCA Plate Transformer: 995 VCT @ 360 Ma. Pri: 115 V. w/taps @ 60 CPS. Herm.-sld. $3.95.

Johnson Variable Capacitors: Dual 215/215 Mmfd. .125″ Spacing (4500 Volts). $7.75.

Compact Xmtg. Variable Capacitor: Max. capacity 1000 Mmfd @ 4,000 VDC (w/built-in oil bath chamber). $8.50.

Johnson Socket #122-101: Designed for VHF use with tubes such as the 826, 832, 4D32, 4D22, PL6549 and PL6569, etc. Special terminals permit direct mtg of grid coils. 7 pin wafer socket. $1.00.

866A Filament Transformer: Pri: 110, 115 or 120 VAC @ 60 CPS, 1 phase. Sec: 2.55 VAC @ 10 Amps. Fully enc. case. Order Westinghouse #D175475. $3.95.

Isolation Step-Down Transformer: Pri: 220 or 440 VAC (nominal) 50/60 CPS, 1 phase. Sec: 110 or 220 VAC, 50/60 CPS, 1 phase. 0.5 KVA continuous, self-cooled rating. Impregnated. Order G.E. #K-5080638. $14.95.

Variable Capacitor: Range: 18 Mmf to 400 Mmf. Straight-line wave length tuning characteristic. 1000 VAC Peak. 53 Brass plate. 3-23/32″ Overall Length. 3-11/32″ Body Length. 2-1/16″ Body Width. 1-5/16″ High. Mounts by two 6-32 tapped holes, spaced 2-19/32″ center to center, ceramic insulation. Order FTL #NL-81798-2. $2.50.

Add 50¢ Service Charge for orders under $5.00. Prices are F.O.B. NYC.

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(C4)
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Company .....

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For further information, check number 39, on page 126

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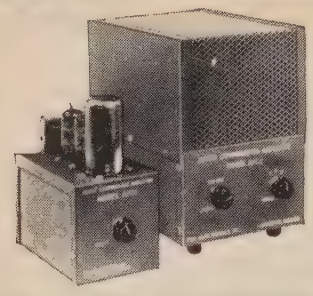
P&H AUDIO COMPRESSOR



FOR MINIMUM DISTORTION
MAXIMUM TALK POWER

100% MODULATION—WITHOUT DISTORTION is practically impossible to attain with most ham rigs. NOW—Thanks to P&H—you can have your cake and eat it too!

Simply connect a P&H MODEL AFC-1 or AFC-2 between the mike and the mike input of any SSB, DSB, AM, PM or FM transmitter—Set the transmitter audio gain control for 100% modulation and FORGET IT! From a WHISPER to a SHOUT—the compressor output level NEVER VARIES MORE THAN 6DB. May also be used on PA systems to maintain high audio output without blasting.

NOT A CLIPPING DEVICE! This is an AVC type compressor, like broadcast stations use. Operation is instantaneous, with no pumping effect. Built-in audio filters and SEPARATE HIGH and LOW IMPEDANCE CIRCUITS.

HIGH IMPEDANCE threshold is set at —52 DB and will provide up to 50 DB of compression with negligable distortion. LOW IMPEDANCE threshold is set at —25 DB, and will provide up to 40 DB of compression when used between the speaker and the audio output of a receiver; resulting in excellent AVC action from receivers with poor RF AVC characteristics.

MODEL AFC-1 (3" x 3" x 5") requires an external power source (often available from transmitter or receiver) and contains a 90-3500 cycle bandpass audio filter.

MODEL AFC-2 (5" x 5" x 7") has a built-in power supply and a switch controlled BROAD-MEDIUM-SHARP audio filter.

MODEL AFC-2CW is identical to the AFC-2 except for much sharper audio filters. It is intended for use with filter type exciters and for CW reception when used in the speaker line of receivers.

MODEL AFC-1 With tubes (less power supply).....$32.95
MODEL AFC-2 or AFC-2CW Complete $54.95

P&H ELECTRONICS INC.
424 Columbia Lafayette, Ind.

For further information, check number 41, on page 126

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Durable, silver plated, precision made. Only 5/8" hole is needed, no screws.
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WANTED: Gonset 3-30 converter, 12 volts. VE6OH, 17 17th Ave. So. Lethbridge, Alta, Canada.

Antenna, complete, vertical, 75, 40, 15 meters. $3. W6WFR, 199 Random, Walnutcreek, Calif.

TECH MANUALS—BC-375 $7.50; SCR-274N $7.00; AR VHF $8.50; ARC-1 $8.50; ART-13 maintenance $12.50, c bration $5.00; operation $3.50; URC/4 $4.00; BC-224, 3 348 $6.00; ARC-5 LMHF $12.00, LM manuals $5. ARR-5,7, $7.00. All postpaid, thousands of others on ha write your needs. Propagation Products Co., Box 25 Norfolk, Va.

GONSET GSB-100 for sale. Like new condition. Year o $350. George Scott, W2LFX, 6 Stuart Drive W., Glen Co N. Y. ORiole 6-2088.

WANT: 75A-3 and accessories. E. Shafer, 3479 Kersd Rd. Cleveland 24, Ohio.

SELL: Heathkit DX-100, NC-300, HyGain 10 and 2 me beams, DB-23A, misc. Ham and hi-fi equipment. A Supro Hawaiian guitar. K2IKZ

DID YOU know that the price of each word for an ad this space in only 5¢? Did you also know that there is longer a minimum charge? The total number of words this ad costs only $3.25. At this price, you really can't pa up selling that old power transformer or tube socket, th previously cost less than the entire advertisement!

KWM-2 RTTY [*from page 34*]

space frequencies. The isolation amplifier was later added to make local copy from the a.f.s.k. oscillator possible. The parts layout is not critical, so crowded construction may be used. Capacitors C_1 through C_5 and inductance L_1 must be high quality components to ensure a pure undistorted sine wave output. The *RC* filter in the keying line equalizes the differences in keyboard contact resistances and helps suppress switching transients.

Initial Alignment

A digital frequency counter or tuning fork standard should be used to align the a.f.s.k. oscillator. With the SEND-RECEIVE switch on SEND and the keyboard plug removed, adjust C_3 for an oscillator output frequency of 2125 c.p.s. Put a shorting plug in the keyboard jack and adjust C_4 for 1275 c.p.s. Go back and check the first adjustment as there may be some interaction. The discriminator filters in the converter may now be adjusted using the a.f.s.k. oscillator to obtain the standard frequencies.

KWM-2 Operation

The KWM-2 is tuned and loaded in accordance with the instruction manual. The EMISSION switch is placed on L.S.B. and the MIC GAIN is set to 11 o'clock. With the SEND-RECEIVE switch on SEND, the OSCILLATOR GAIN is adjusted to give a plate current indication of 85 ma on the KWM-2. WØYZD at Collins Radio has confirmed that this level should not cause either distortion of the signal or damage to the KWM-2. The LOCAL COPY GAIN is then adjusted to give errorless local copy. You are now ready to further enjoy the versatile KWM-2. ■

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	1AX2	.62		6AX4	.65		12AJ6	.46
	1B3GT	.79		6AX7	.64		12AL5	.45
	1DN5	.55		6BA6	.49		12AL8	.95
	1G3	.73		6BC5	.54		12AQ5	.52
	1J3	.73		6BC7	.94		12AT6	.43
	1K3	.73		6BC8	.97		12AT7	.76
	1L6	1.05		6BD6	.51		12AU6	.50
	1LN5	.59		6BE6	.55		12AU7	.60
	1R5	.62		6BF6	.44		12AV5	.97
	1S5	.51		6BG6	1.66		12AV6	.41
	1T4	.58		6BH6	.65		12AV7	.75
	1U4	.57		6BH8	.87		12AX4	67
	1U5	.50		6BJ6	.62		12AX7	.63
	1X2B	.82		6BK7	.85		12AZ7	.86
	2AF4	.96		6BL7	1.00		12B4	.63
	3AL5	.42		6BN4	.57		12BA6	.50
	3AU6	.51		6BN6	.74		12BD6	.50
	3AV6	.41		6BQ5	.65		12BE6	.53
	3BA6	.51		6BQ6GT	1.05		12BF6	.44
	3BC5	.54		6BQ7	.95		12BH7	.73
	3BE6	.52		6BR8	.78		12BL6	.56
	3BN6	.76		6BU8	.70		12BQ6	1.06
	3BU8	.78		6BY6	.54		12BY7	.74
	3BY6	.55		6BZ6	.54		12BZ7	.75
	3BZ6	.55		6BZ7	.97		12C5	.56
	3CB6	.54		6C4	.43		12CA5	.59
	3CF6	.60		6CB6	.54		12CN5	.56
	3CS6	.52		6CD6	1 42		12CR6	.54
	3CY5	.71		6CF6	.64		12CU5	.58
	3DK6	.60		6CG7	.60		12CU6	1 06
	3DT6	.50		6CG8	.77		12CX6	54
	3Q5	.80		6CM7	.66		12DB5	.69
	3S4	.61		6CN7	.65		12DE8	.75
	3V4	.58		6CR6	.51		12DL8	.85
	4BC5	.56		6CS6	.57		12DM7	.67
	4BC8	.96		6CU5	.58		12DQ6	1.04
	4BN6	.75		6CU6	1 08		12DS7	.79
	4BQ7	.96		6CY5	.70		12DZ6	.56
	4BS8	.98		6CY7	.71		12EL6	.50
	4BU8	.71		6DA4	.68		12EG6	.54
	4BZ6	.58		6DB5	.69		12EZ6	53
	4BZ7	.96		6DE6	.58		12F5	.66
	4CS6	.61		6DG6	.59		12F8	.66
	4DE6	.62		6DQ6	1.10		12FM6	.45
	4DK6	.60		6DT5	.76		12K5	.65
	4DT6	.55		6DT6	.53		12SA7M	.86
	5AM8	.79		6EU8	.79		12SK7GT	.74
	5AN8	.86		6EA8	.79		12SN7	.67
	5AQ5	.52		6H6GT	.58		12SQ7M	.73
	5AT8	.80		6J5GT	.51		12U7	.62
	5BK7A	.82		6J6	.67		12V6GT	.53
	5BQ7	.97		6K6	.63		12W6	.69
	5BR8	.79		6S4	.48		12X4	.38
	5CG8	.76		6SA7GT	76		17AX4	67
	5CL8	.76		6SK7	.74		17BQ6	1.09
	5EA8	.80		6SL7	.80		17C5	.58
	5EU8	.80		6SN7	.65		17CA5	.62
	5J6	.68		6SQ7	.73		17D4	.69
	5T8	.81		6T4	.99		17DQ6	1.06
	5U4	.60		6U8	.78		17L6	.58
	5U8	.81		6V6GT	.54		17W6	.70
	5V6	.56		6W4	.54		19AU4	.83
	5X8	.78		6W6	.69		19BG6	1.39
	5Y3	.46		6X4	.39		19T8	.80
	6AB4	.46		6X5GT	.53		21EX6	1.49
	6AC7	.96		6X8	.77		25BQ6	1.11
	6AF3	.73		7AU7	.61		25C5	.53
	6AF4	.97		7A8	.68		25CA5	.59
	6AG5	.65		7B6	.69		25CD6	1.44
	6AH6	.99		7Y4	.69		25CU6	1.11
	6AK5	.95		8AU8	.83		25DN6	1 42
	6AL5	.47		8AW8	.93		25EH5	.55
	6AM8	.78		8BQ5	60		25L6	.57
	6AN4	.95		8CG7	.62		25W4	.68
	6AN8	.85		8CM7	.68		25Z6	.66
	6AQ5	.50		8CN7	.97		35C5	.51
	6AR5	.55		8CX8	.93		35L6	.57
	6AS5	.60		8EB8	.94		35W4	.52
	6AT6	.43		11CY7	.75		35Z5GT	.60
	6AT8	.79		12A4	.60		50B5	.60
	6AU4	.82		12AB5	.55		50C5	.53
	6AU6	.50		12AC6	.49		50DC4	.37
	6AU7	.61		12AD6	.57		50EH5	.55
	6AU8	.87		12AE6	.43		50L6	.61
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Kit 15 Volume Controls
Kit 56 Tube Sockets
Kit 65 Tubular Condensers
Kit 500 Lugs & Eyelets
Kit 10 Bathtub Oil Cond's
Kit 5 lbs. Surprise Package
Kit 10 Transmit Mica Cond's
Kit Glyptal & Cement
Kit 3 Phone/Patch Xfmrs
Kit 4 AN/Reflector Lites
Kit 6 Insltd Tuning Tools
Kit 4 "Suncells" Asstd.
Kit 5 Sub-Min Tubes

Order Ten Kits We Ship Eleven!!!
ONE EACH ABOVE KIT ONLY

"TAB" Tubes Factory Tested, Insptd, Six Months Guaranteed! No Rejects! Boxed!

GOVT & MFGRS Surplus! New & Used

0A2	.89	6BZ7	1.25	*We Buy & Sell*	
0A3	.80	6C4	.45	43	.75
0B2	.65	6C5	.69	45	.49
0C3	.70	6C6	1.08	50L6	.69
0D3	.50	6C8	1.08	RK59	1.39
0Z4	.79	*We Trade!*		RK60	1.17
1A7	.90	6CB6	.89	HY69	2.20
1B3	.99	6CD6	1.49	75	.81
1L4	.82	6CF6	.85	HY75	5.00
1R4	.5/$1	6CL6	1.40	83V	.95

We Swap Tubes! What Do/U Have?

1R5	.78	6CB6	.89	4PR60A	37.50
1S4	.78	6CG8	1.12	4-125A	27.50
1S5	.68	6CM6	.79	4X150G	15.00
1T4	.85	6CS6	.70	4X250B	41.00
1T5	.95	6CU6	1.29	4-400A	41.75
1U4	.6/$1	6D6	.99	4E27A	39.00
1U5	.75	6E5	.79	250TL	19.45
1X2	.99	6F4	2.49	307A	2/$1
2C39A	Q	6F5	.63	316A	5/$1
2C40	5.50	6F6	.99	VR92	5/$1

Send 25¢ for Catalog!

2C43	6.50	6F7	.99	388A	3/$1
2C51	2.00	6F8	1.39	350A	2.45
2D21	.65	6H6	.59	350B	1.75
2E22	1.75	6J4	1.72	371B	.95
2E24	1.90	6J5	.59	5146	3.90
2E25	2.50	6J6	.59	416B	16.00
2E26	2.75	6J7	.99	450TH	43.00
2E30	Q	6J8	1.39	450TL	43.00
2E35	1.60	6K6	.59	460	11.50
2K25	9.75	6K7	.79		

All Tubes Stocked at Low Prices!

2K26	34.00	6K8	.99	703A	Q
2K29	30.00	6L6	1.19	707B	3.50
2V3	2/$1	6SN7	.72	715C	10.90
2X2	.48	6T8	.98	717A	5/$1
3A4	.70	6V6GT	.90	723AB	5.00
3A5	1.00	6X5	.49	725A	2.75
3API	5.95	12AT6	.59	803	3.50
3BP1	3.99	12AT7	.89	804	8.85
3C24	3.50	12AU6	.63	805	6.00
3D23	3.95	12AU7	.69		

We Buy! / *We Sell!* / *We Trade!*

3E29	6.00	12AX7	.79	807	1.10
3Q4	.68	12AY7	1.29	5/$5, 10/$12	
3Q5	.86	12B4	.95		
4-65A	13.50	12BA6	.65	811	3.45
4-125A	27.50	12BA7	.99	811A	4.41
4-250A	34.00	12BD6	.59	812	3.30
4X150A	Q	12BE6	.59	813	8.00
4X250	36.00	12BH6	.79	815	1.75
4X500	37.00	12BH7	.89	826	.99
5API	2.95	12BY7	1.00		

Wanted Test Sets and Equipment

5BP1	7.95	12BZ7	.99	828	9.00
5BP4	7.95	12H6	.75	829B	8.00
5CP1	4.95	12J5	.69	832A	6.00
5CP7	9.00	12J7	.69	833A	36.00
5R4	1.00	12J8	1.35	837	2/$2
5T4	.90	12K8	.89	866A	2.45
5U4	.99	12SA7	.69	954	10/$1
5V4	.89	12SC7	.89	955	3/$1
5Y3	.60	12SF5	.69	957	3/$1
5Z3	.89	12SG7	.89	958A	2/$1

Send 25¢ for Catalog!

15GP22	89.00	12SH7	.89	991	5/$1
6A7	1.00	12SJ7	.75	1614	2.75
6A8	.99	12SK7	.75	1619	5/$1
6AB4	.59	12SL7	.79	1620	2.00
6AC7	.72	12SN7	.69	1625	3/$1
6AG5	.65	12SQ7	.69	1626	5/$1
6AG7	.75	12SR7	.69	1629	4/$1
6AK5	.69	15E	1.19	2050	1.25
6AL5	.59	15R	4/$1	5517	1.25
6AQ5	.66	FG17	Q	5608	3.95

Top $$$ Paid for 304TL, 813, 811A, 812A Tubes

6AR6	1.95	19T8	1.16	5618	3.25
6AS7	3.49	24G	3.50	5651	1.35
6AT6	2/$1	25A6	1.19	5654	1.20
6AU6	.79	25A7	2.19	5656	4.25
6B8	1.35	25C5	.81	5663	1.15
6BA6	.59	25L6	.72	5670	.90
6BE6	.59	25T	4.00	5686	1.75
6BG6	1.49	25Z5	.72	5687	1.15
6BH6	.79	25Z6	.75	5691	4.70
6BJ6	.72	26A7	3.69	5725	1.95

Top $$$ Paid for XMTR Tubes!

6BK7	.99	FG27	8.28	5732	2.00
6BL7	1.35	HV27	19.39	5736	85.00
6BN4	.69	28D7	.89	5749	1.95
6BN6	1.08	FG33	15.00	5750	2.75
6BN7	1.99	EL34	3.49	5751	1.25
6BQ6	1.19	35A5	.69	5814	1.20
6BQ7	.99	35L6	.59	5879	1.20
6BX7	1.11	35T	4.49	5894	$12.00
6BY5	1.19	35Z5	1.25		
6BZ6	.91	RK39	2.99	No See—Write!	

"TAB" TERMS: Min Order $3—25% with order F.O.B. New York. Ten day guarantee, price of mdse. only. Our 17th year.

Prices shown are subject to change.

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SILICON DIODES 750MA* TOP HATS

General Purpose 400 PIV at 300 MA
Special 2 for $1 20 for $7

rms/piv 17/25 14¢	rms/piv 35/50 19¢	rms/piv 70/100 29¢	rms/piv 140/200 34¢
rms/piv 210/300 43¢	rms/piv 280/400 55¢	rms/piv 350/500 70¢	rms/piv 420/600 $1.00
rms/piv 490/700 $1.25	rms/piv 560/800 $1.50	rms/piv 630/900 $1.70	rms/piv 700/1000 $2.00

Low Priced * T200 SILICON DIODES rated 380piv/266rms @ 200Ma @ 100°C 36¢ each; 10 for $3.25; 100 for $27;

***CAPACITOR INPUT DERATE 20%:** ($5 or more this item we pay P.P./U.S.A.)

SPECIAL! TRANSISTORS & DIODES!!!
Factory Tested & Guaranteed!

FULL LENGTH LEADS

2N123 PNP 45¢, 12 for $5, 100/$37
2N292 NPN 45¢, 12 for $5, 100/$37
2N293 NPN 45¢, 12 for $5, 100/$37
2N223 PNP 80¢ ..... 100/$65
2N597 PNP $1.90 ..... 6/$10
2N598 PNP $1.90 ..... 6/$10
2N599 PNP $3.50 ..... 3/$10

GENERAL PURPOSE—PNP—COMPUTER GRADE!
Use as Amplifier—Oscillator—HiFi Logic—Servoamp—Power Supply Pulse Amplifier or High Current Switch Veb. Vce. Veb Approx 40V
GP3C rated 300 Milliwatts 65¢, @ 10 for $5, 100 for $39
GP10C Rated 1 watt 90¢, 6 $5, 100 $63

2N155 $1.39, 2N176 $1.80, 2N177 $1, 2N178 $1.75, 2N247 $1.50, 2N255 $1.20, 2N270 $.95, 2N274 $1.25, 2N408 $.80, 2N544 $1.20, 2N578 $1.80, 2N579 $2.20, 2N581 $1.25, 2N582 $2.10, 2N174 $8.50, 2N443 $6.50, 2N670 $1.60, 2N671 $2.

GTD! POWER-DIAMOND-TRANSISTORS
Factory Tested
***MFGRD in U.S.A.
Replaces Medium & HiWattage Types
2N155, 2N156, 2N234, 2N256, 2N307, 2N554

GENERAL TO 3GP 80¢ @,..... 20 for $15
PURPOSE ..... 100/$65
$10 or more this item we pay P.P./U.S.A.)

8 TOPHAT SILICON DIODES $1
EXPERIMENTERS KIT. USE AS STABISTORS, ZENOR DIODES METER PROTECTION CLIPPER & RECTIFIERS! $10 VALUE.

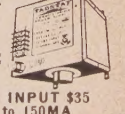
DIAMOND BASE MICA MTG KIT... $ .30
ROUND BASE MICA MTG KIT ..... $ .30
DELCO POWER HEAT SINK WITH FINS 80 SQ" $1.25
KIT DIODES COMPUTER ..... 20¢, 8/$1
KIT TRNSTR NPN or PNP 39¢@, 3 for $1
IN34A DIODES 23¢ @, 10 for $2, 100/$18
($10 or more this item we pay P.P./U.S.A.)

GTD! HIPOWER-ROUND-TRNSISTRS Factory Tested
***MFG in U.S.A.

2N277 or 2N441 $1.40 @, 4/$5, 25/$28, 100/$90, 2N-278 or 2N442 $3.75 @, 4/-$12, 25/$64, 100/$225, 2N173 or 2N443 $5.00 @, 4/$16, 25/$90. TO 36GP—**General Purpose** (Ic15A) 5 for $5, 40/$36, 100/$80 ($10 or more this item we pay P.P./U.S.A.)

"SUNTAB"® SELENIUM PHOTOCELL
2BP 75μa ¾x⅝" ¢40@, 11 for $4
5AP 1" Dia., 5BP/Sq & Rect 220μa,¢55
15AP 750μa, 1¾" Dia, $1.45@, 4 for $5
10BP 350μa, 1-11/16" Rect. ¢75@, 10 for $7
10CP 750μa, 1⅞x1⅜" ¢1.45@, 4 for $5

NEW POWER CONVERTER
12VDC to 500VDC
up to 200MA
100 Watts; Tap at 250VDC
***Type C1250E $35**



TYPE C650E FOR 6VDC INPUT $35
12VDC to 250VDC up to 150MA
Type C1225E $30
C625E for 6VDC input $30

"TAB" TOROID XFMRS for TRANSISTOR POWER CONVERTERS!
T6-500E/6VDC Impt, 500VDC & Tap, Max 200Ma $15. T12-500E/12VDC Inpt, 500VDC & Tap, Max 200Ma $15. T6-250E/6VDC Impt, 250VDC, Max 150Ma $14. T12-250E/12VDC Inpt, 250VDC, Max 150Ma $14.

NEW BATTERY CHARGER BC6-12V OR 6V OR 12 VOLT BATTERIES, ICKLE & FULL CHARGE up to 4 AMP

ges 6 & 12 volt batteries
t BC6-12VB $10.00
-12VK Preassembled
it 7.50
e except rated 2.5A
C612AB 8.00
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Full Length TRANSISTORS Leads

Computer Grade—Tested Guaranteed For General Purpose Use
Amplifiers - Oscillators - HiFi Logic - Servoamps - Power Supplies Pulse Amp or High Current Switch Circuits

Absolute Max Ratings at 25°C
PNP — TYPE 2N670 — 300MW
eb approx — 40v Ic approx max — 2A
ce approx — 40v Hfe approx 40 to 250
eb approx — 40v Diss approx 300Mw
ost $3.98. SPECIAL 95¢ ea. 4 for $3.
8 for $5
NP — TYPE 2N671 — One Watt*
cb, Vce, Veb approx — 40v
approx—2A *heatsink Mtd 1 Watt
fe approx 40 to 250
egular Cost $4.13
PECIAL $1.15 2 for $2, 5 for $4

NEW "VACDAC"® SILICON TUBE REPLACEMENTS

TH BUILT IN RF SURGE & SERIES BALANCING PROTECTION

PE	VRMS/PIV	AMPS	PRICE
66	5000/10400	0.3	$20.00
16	5000/7000	0.3	$16.00
R4	1900/2800	0.5	$15.00
U4	1120/1600	0.6	$ 8.00

! ! ! TUBE SPECIAL ! ! !
X150D — Removed from Govt. equipment. Tested. $3 ea., 2 for $5. Filament Xmr $2. First come, first served.

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TAB" Silicon Rectifier Replacement
Non-Aging Hermetically Sealed
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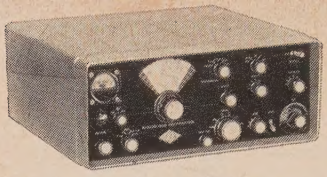
ENIUM F.W. BRIDGE RECTIFIERS

C / P	18VAC 14VDC	36VAC 28VDC	72VAC 54VDC	130VAC 100VDC
½	$1.00	$1.90	$3.85	$5.00
1	1.30	2.00	4.90	8.15
2	2.15	3.00	6.25	11.10
3	2.90	4.00	8.60	13.45
6	4.15	8.00	18.75	31.90
0	6.10	12.15	26.30	41.60
2	7.75	14.90	30.95	43.45
0	12.85	24.60	*Write For*	
4	15.00	29.45	*Rectifier Catalog*	

Send 25¢ for Catalog



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No. 78 SZ 175.....**$399.50**
3350 12-Volt D.C. Power Supply
No. 78 SZ 176.....**$145.00**

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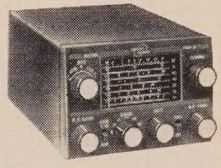
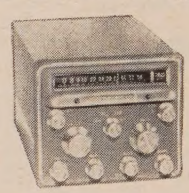
ALLIED has what you need for Mobile time!

PMR-8

AF-68





PIERSON KE-93 Receiver
No. 77 SU 777.....**$249.0**
6-12 VDC Power Supply
No. 77 S 778.....**$49.9**

ELMAC AF-68 Transmitter
No. 77 SX 902.....**$205.00**
PMR-8 Receiver
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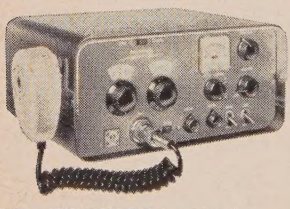
15-DAY TRIAL PRIVILEGE • 90-DAY WARRANTY

ONLY $2 DOWN on orders up to $50; only $5 down on orders up to $200; only $10 down over $200. Up to 24 months to pay...

FOR THAT BEST DEAL on the new equipment you want, write to Jim Sommerville, W9WHF, c/o Allied, or stop in at our Ham Shack and meet Joe Huffman, W9BHD, Joe Gizzi, W9HLA, Jack Schneider, W8CZE, Burt Fischel, W9VOB...

HAM-TO-HAM HELP—Our staff of 35 Hams will go all-out to give you the help you want, whether you write or call in or visit us in person.



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- ☐ No. 77 SZ 950 Polytronics
- ☐ No. 77 SX 902 Elmac AF-68
- ☐ No. 78 S 161 Elmac PMR-8
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City_____Zone_____State_____

For further information, check number 3, on page 126

NATIONAL'S NC-303

HIGHEST MECHANICAL STABILITY

LOWEST THERMAL DRIFT

MAXIMUM SSB/AM/CW VERSATILITY

Three decisive reasons why National's NC-303 outperforms all other receivers
n its price class:

HIGHEST MECHANICAL STABILITY—solid chassis and component construction,
re-loaded double-spaced tuning gang and positive detent bandswitch assure sta-
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LOWEST THERMAL DRIFT—National's exclusive "high-zero" temperature compen-
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al stability unequalled by competitive receivers.

MAXIMUM SSB/AM/CW VERSATILITY. For The SSB User: "IF Shift" selectable
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and and 12" dial scales for VHF converters / Accessory socket /2 Kc dial calibration
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Only $44.99 down*

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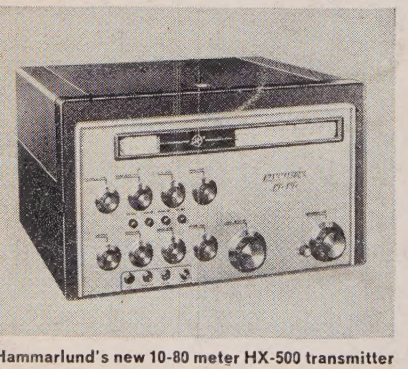
"Business end" of the HX-500 showing the parallel-connected RCA-6146's "raring to go".

HAMMARLUND HX-500

...uses RCA-6146's



Hammarlund's new 10-80 meter HX-500 transmitter

Well-known in amateur radio for more than a gener Hammarlund again makes transmitter history. This tim the 100-watt HX-500, advance-designed for virtually mode of operation in use today—SSB, DSB, CW, FM, FS RTTY. We are pleased to point out that Hammarlund d ers specified a pair of RCA-6146 beam power tubes for the

Today more rigs use RCA-6146 beam power tubes tha other power type or brand. They are conservatively rated tremendous reserve of cathode emission, deliver full output at relatively low plate voltage—and they are econo

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